SCIENTIFIC AMERICAN

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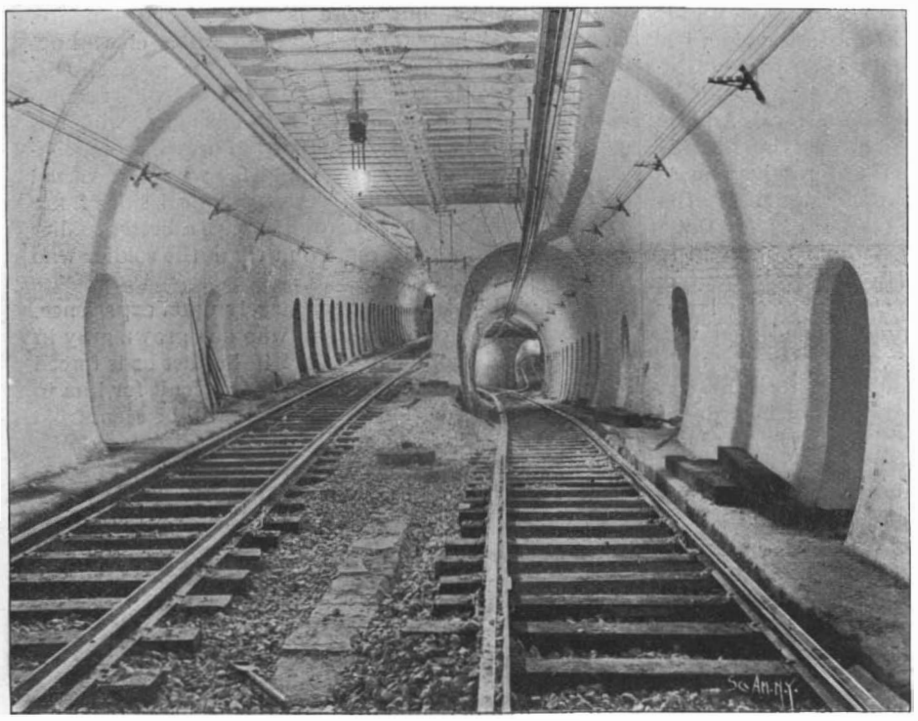
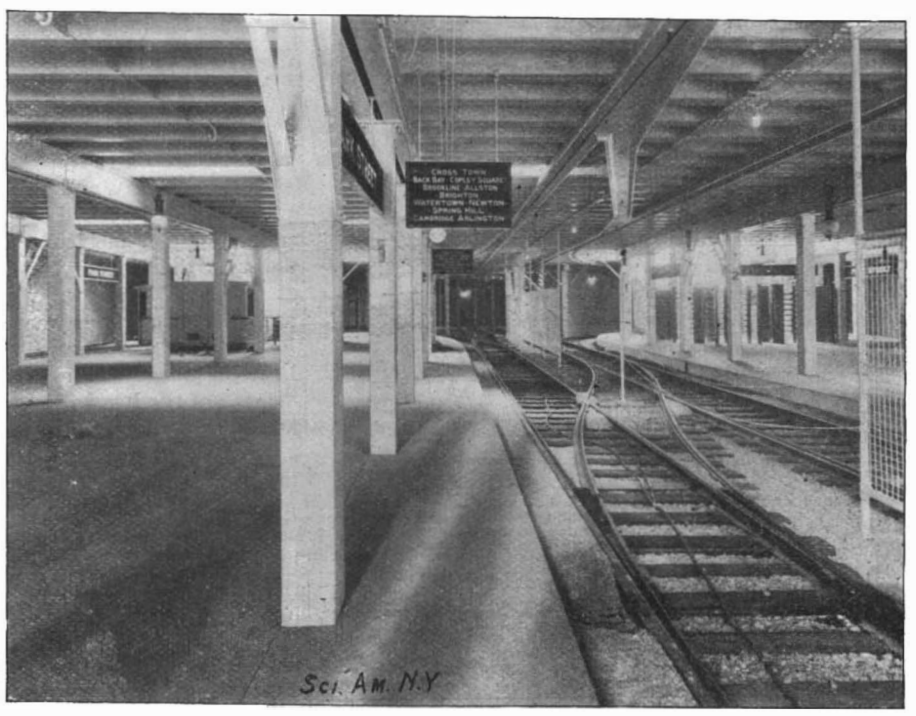


THE SUBWAY SOUTH ON TREMONT STREET, SHOWING CROSSING OF TRACKS AT DIFFERENT GRADES.



INTERIOR OF THE PARK STREET STATION LOOKING NORTH, SHOWING LOOP.

THE BOYLSTON STREET STATION, LOOKING DOWN TREMONT STREET, THE SUBWAY BEING UNDER THE MALL AND COMMON.

THE NEW BOSTON SUBWAY FOR TROLLEY CARS.—[See page 184.]

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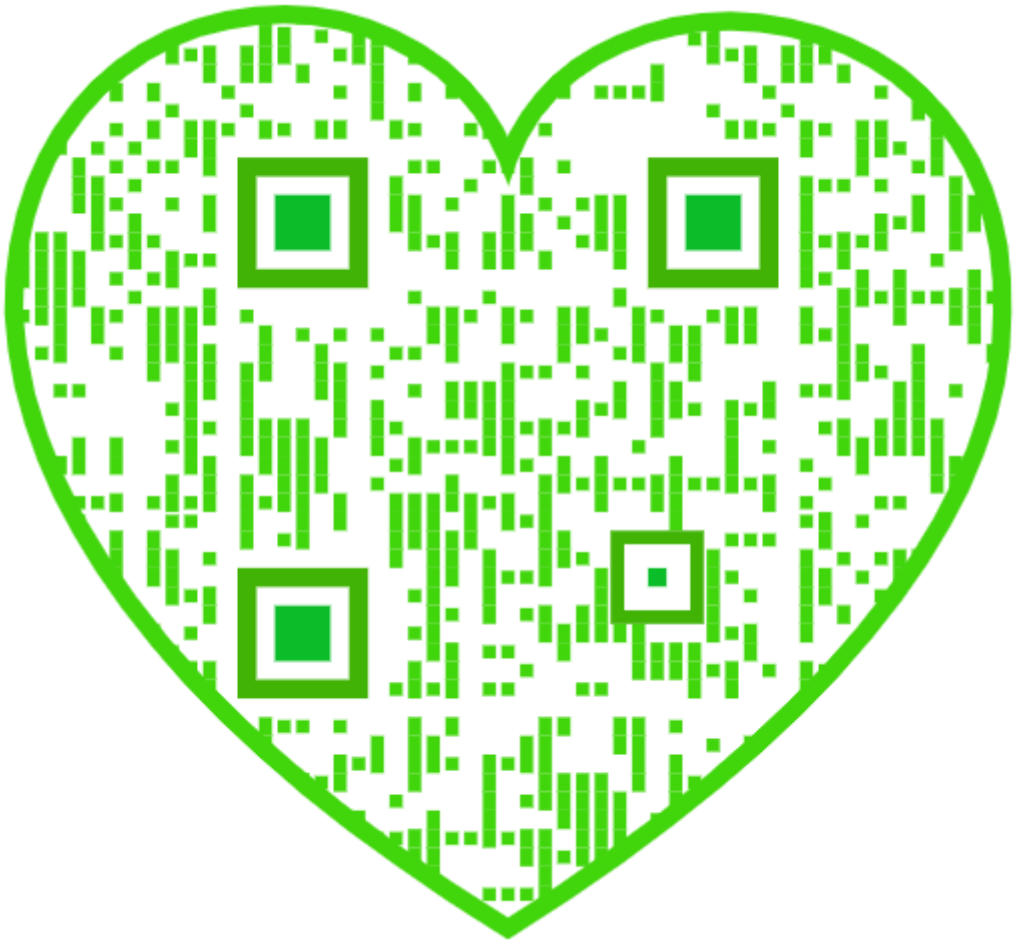

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OUR BIG WAR SHIPS IN FLEET PRACTICE.

During three days of last week Assistant Secretary of the Navy Roosevelt inspected, participated in, and, no doubt, infused with some of his own energy and decision the operations of the North Atlantic squadron in some of the most satisfactory fleet practice that has yet been achieved by our new armorclad vessels. There were seven vessels in the fleet, including the splendid armored cruisers New York and Brooklyn and the battleships Indiana and Iowa, and it had been arranged that Mr. Roosevelt, on the dispatch boat Dolphin, should meet the squadron, anchored to await him, about thirty miles east of the Virginia Capes, when the squadron maneuvers were to be carried on for two or three days out of sight of land. It was at Mr. Roosevelt's own suggestion, it is said, that this fleet practice was arranged for and carried out, and its results cannot fail to be highly satisfactory to all who understand how highly important perfect fleet organization is in modern naval warfare.

Immediately upon Mr. Roosevelt's arrival, Admiral Sicard, from the New York, which was the flagship, signaled the battleship New York to receive the Assistant Secretary, and also to "clear for action," so that when he came aboard everything was ready for target practice under such conditions as would obtain in an action with an enemy. When Mr. Roosevelt went on the bridge of the Iowa, with the captain of the latter, and the alarm gongs were rung, officers and men were instantly at their several stations, ready for work, the boats in places where they would least feel the concussion of the heavy guns, and everything in order as it would be in actual war. A target had been placed 2,500 yards away, and firing at it was at once commenced with an 8 inch gun, to be followed with projectiles from the 12 inch guns and the actual service of the entire battery of the vessel. The battleship and her crew are said to have passed splendidly through this first trial at actual cannonading practice; a whaleboat was put out of service and some skylights broken, but nothing more serious, while the accuracy of the firing is said to have shown high skill in the gunners. The Brooklyn, the New York and the Indiana subsequently had similar practice, searchlights being used in the evening to pick up supposed hostile torpedo boats, and there was also a searchlight drill by all the vessels of the squadron. A novelty of the occasion was the release of carrier pigeons from the New York, the pigeons carrying dispatches from the squadron to Norfolk, whence they were telegraphed to Washington.

A SCHOOL OF FIRE EXTINGUISHMENT.

The State safeguards the individual, hedging him about by wise laws which protect him from the services of incompetent persons. Thus disease may only be cured by men who are possessed of the proper medical knowledge to insure that the treatment shall be scientific; cases in court may be conducted by men only who have assured certain members of the bench selected for that purpose that they are properly equipped with the necessary legal knowledge to give their clients the benefit of proper advice and counsel. In fact, there are no less than forty-three professions and occupations which require some license from the State before they can be conducted; but in the matter of protection from fire the individual has been neglected by the State. It is a popular belief that every man who is able bodied is fit to fight fire, but this is erroneous. Fire extinguishment is accomplished as much by mental as by brute force.

Unfortunately, in many of our great cities fire extinguishment is taken up as a recompense for political support, and the fire department is looked upon as an important center for partisan and political influence. That those who regard the fighting of fire as a profession are totally opposed to this political influence and corruption is shown by many reports of firemen's conventions, and these brave men deserve all honor for their faithful service and certainly should have a life tenure of office.

Removals from office in a fire department, either of the chief or firemen, should only be made for incompetency or where there is good ground for believing that the service would be permanently improved. Fire extinguishment is very largely a matter of experience, and the longer the fireman holds his position, the more efficient he ought to be.

The status of the volunteer fireman is not more satisfactory. Too many men are enrolled as members of the volunteer fire companies either to escape local taxation, jury duty, or to secure social advantages, for in small towns the volunteer fire company often partakes of the nature of a social club. In many cases fire service may be avoided by the payment of a fine. A State law should be framed which would define the position of the volunteer fireman and his qualifications for enrollment and to provide for severe penalties for non-attendance at fires. The State should also have regular supervision of the fire apparatus. Attention to these matters would save an enormous fire loss.

We now come to the consideration of a school for fire extinguishment. At the present time, according to a well informed authority upon the subject, there is no school of fire extinguishment in the world. At Paris and Berlin the firemen are given lectures illustrated by dissected model houses, and while this is a step in the right direction, it does not go far enough. The nearest approach to a school of fire extinguishment is the fire drill with lectures which is given at the Cambridge Manual Training School for Boys, but this is only a minor part of the school work. In many large cities firemen are instructed in the use of the special apparatus used in that city. No attempt is made to take up the subject of controlling and extinguishing fire as a science. In most cities the rules and regulations must be thoroughly studied by firemen before promotion, and this promotion is only given after examinations at which various questions relating to the saving of life and the control of fire are asked. This now obtains in nearly all cities, but there is no uniform standard. One city may have one set of rules and a city a hundred miles away may have another. The great fire departments of our large cities have a world-wide reputation, and justly so, but even their efficiency, which is conceded, would be increased by the presence of a considerable number of the rank and file who were versed in the theoretical as well as the practical side of fire extinguishment. The general is always a better soldier for passing through West Point than the soldier who rises from the ranks.

Fire fighting is based very largely upon experience, and the experience of one man who has grown gray in fighting the demon of fire is lost if he dies or is forced from his position, and it would be difficult for him to impart this information to others. It will be seen, from what has already been said, that there is room for a school of fire extinguishment, either as a State or a national institution. A course of six months, with a practical daily drill, would insure the competency of the fireman and fit him to take charge of a fire house, while a post-graduate course might be given which would fit the fireman as a battalion chief or fire chief.

Such a school should be established in a great city like New York. Here the student of fire extinguishment would find a paid fire department, maintained at an expense of upward of $2,000,000 per annum, equipped with the latest forms of apparatus. New York would give abundant material for study. It has streets in which the traffic is very congested; it possesses high buildings, which have added a new problem to the fighting of fire; it also has an extended river front, giving the embryo fireman a chance for studying fires in boats, piers and grain elevators.

Great manufacturing plants, railroad stations, all important risks, are provided at the very doors of the school, while in the suburbs excellent examples are given of what is technically known as the "village street," in which the buildings are all massed together, and the open country, where the risks are isolated. The city would also give an abundant chance for the examination of electrical plants and would enable the student to see how immunity is best obtained from fire caused by electricity, and the handling of a fire without interference with the traffic of the street and elevated cars.

The school should possess large grounds, enabling the firemen to practice with approved apparatus. Laboratories and testing furnaces should be established in which samples of combustible material could be studied and tests made of fireproof methods of construction and of new fire extinguishing apparatus. Lectures on chemistry with special reference to combustion should be given and the various methods of building discussed. Papers by prominent fire chiefs could be read, which would be of great value, as many of them are specialists in certain classes of fires. The legal aspects of fire could be treated and the duties of the fire marshal could be discussed, enabling the fireman in the small city or village to give valuable evidence before the courts on the incendiary origin of fires.

The need of such a school may be brought out by a couple of examples. In one great city the firemen turned a hose on a flaming gas jet in a cellar and a few minutes later four men were hurled through the windows by the explosive mixture of gas and air. The firemen should be taught to plug gas pipes with soap or pieces of wood. In another city the firemen misjudged the height of the dwelling house, and the short ladder which was run up nearly cost a life. Graduates of a fire school would be taught to gage distances accurately.

The necessity of a school for fire extinguishment is evident, not so much for the firemen of large cities as for those who work in villages and the small city. Such a school would dignify the calling until it reached the stage of a profession and would tend to render life more secure and diminish the loss of property.

RAPID WORK IN THE CONSTRUCTION OF NEW YORK ELECTRIC STREET RAILWAYS.

Probably never before in its history have so many miles of the streets of New York City been torn up and rendered almost impassable to travel as at the present time. On the east side the work of changing the Fourth and Madison Avenue line from its old horse

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car system to that of the electric conduit trolley is being prosecuted simultaneously in different sections which extend over almost the entire length of the line, and it is expected the section between the Grand Central Depot and the General Post Office will be in operation early in October. In this work six thousand men have been employed for more than three weeks past, and, great as has been the temporary public inconvenience, it must be conceded that the contractors are making every endeavor to push the work as rapidly as possible. On the west side of the town, also, and in some of the cross streets, the Broadway and the Third Avenue lines are doing work on miles of streets, each endeavoring to advance the work ahead with all possible speed. This strife on the part of the various established lines of surface street railways to get ahead of each other in putting their roads in condition for the greatly increased transportation now demanded of them affords a striking object lesson on the imperative need which exists for the long delayed, and so much talked of, rapid transit system, and demonstrates besides the possibilities and advantages of a systematic division of labor in street railway construction, said to be the most rapid yet undertaken.

THE CHAINLESS BICYCLE.

There is a general impression among those who follow the developments of bicycling that the year 1898 will see the chainless wheel firmly established as a rival to the chain-driven type. More than one of the leading manufacturers have lately expressed their intention of offering to the public a bevel geared machine, or its equivalent. It is freely stated that the mechanical difficulties, which have been made the subject of considerable and costly experiment during the past two or three years, have been thoroughly mastered, and that the chainless wheel has been brought to a pitch of perfection which warrants the launching of a few of these machines upon the market.

The idea of a chainless bicycle, as many of our readers well know, is not by any means new As far back as 1893, a firm had put on the market a bevel geared wheel, and not a few of these machines may still be seen upon the road, and are apparently giving satisfaction; although, for some reason, there has never been any great demand for this type. To judge from the sentiments of the press, the manufacturers and the wheelmen who take any interest in the subject, there is no question that, if it can be mechanically perfected, the chainless wheel will be incontestably superior to the chain and sprocket type.

It will be an interesting study to consider the two systems on a few leading points of comparison, such as simplicity of parts, ease of running, and durability. As regards the first, it must be admitted that the chain gear has everything in its favor, provided, of course, that the chain is regarded as one piece—which, for the purpose of the present comparison, it fairly may be. A chain that is properly made, with links of equal pitch and uniform hardness throughout, will show an even wear, and may be considered as a single link in the driving mechanism. Assuming the future chainless wheel to be a beveled gear machine, in place of the chain we shall have a shaft, two bevel wheels, and two sets of adjustable ball bearings to transmit the motion from crank axle to rear wheel. While a slight variation in the chain line will not seriously affect the running of the chain and sprocket gear, a similar variation in the bevel gear will produce a binding action that will result in hard running and rapid wear. Hence the gears must be cut and the shafting lined up with the nicest care and accuracy. This, of course, is a mere matter of good workmanship, and the firms that contemplate building these machines will doubtless turn out a smooth running and perfectly aligned gear.

A comparison on the score of friction and ease of running under everyday conditions will probably show results in favor of the bevel gear; whereas a comparison under ideal conditions on the testing machine will show, and, if we remember rightly, has shown, results in favor of the chain. The difference is due to the fact that the bevel gear is always inclosed in a gear case and running in clean oil, whereas on the road the chain is not merely transmitting the power from the cranks, but is using up a certain amount of that power in grinding up the grit and dust of the road into the pasty mess with which the average chain is encumbered. As a matter of fact, the chain has never been given a chance to demonstrate what it can do. In the first place, it is not improbable that, except in the case of the best makes, it receives less care in the selection of its material and the machining of its pins and links than any of the other wearing parts of the wheel. Certainly it does not compare in this respect with the bearings. And whereas the bearings are carefully incased, and various precautions in the way of dust caps and felt washers protect it from dust and mud, the chain, for some inscrutable reason, is left to gather up all the friction-producing matter it may. Except on the ground of appearance, there is absolutely no defense to be offered for a custom which does violence to the first principles of good mechanical practice.

Before the chain is pronounced inferior to the bevel gear, it should at least be given an opportunity to prove its efficiency under the protection of a satisfactory gear case.

What has already been said on the question of friction applies with equal force to the question of durability. A protected bevel gear will undoubtedly outlast an unprotected chain gear; though we think that, under equal conditions, the results might be reversed, particularly if the same high class material and workmanship were put into the chain and sprockets as will be sure to characterize the chainless gear. In such a case the chain gear would have a great advantage in the fact that it is adjustable, whereas the other is not—an advantage which will increase in proportion to the distance the wheel is ridden.

There is one respect, however, in which the chainless wheel will possess an undoubted superiority to the present type, and this is in its compact and shipshape appearance and the ease with which it can be cleaned and kept in presentable shape. It is likely that this will prove to be one of the most important factors in establishing the new type in the public favor; but how far the chainless type will succeed in demonstrating its mechanical superiority to the present popular machine, time and the test of hard usage alone can tell.

THE MENTAL EVOLUTION OF MAN.

In the section on psychology, at the recent meeting of the British Medical Association, at Montreal, Dr. K. M. Bucke, of London, Ont., presented some novel views in a paper bearing the above title. He said: "So-called telepathy and clairvoyance seem to be specimens of nascent faculties. I place in the same class the phenomena of what is often named spiritualism. The labors of the Society for Psychical Research have made it to me plain that these phenomena, as notably in the case of W. Stainton Moses, really exist. And I think that a study of the above-mentioned case, together with that of Mrs. Piper and that of Mary J. Fancher, of Brooklyn, would compel any unprejudiced person to make the same admission. But to me these are not cases in which outside agents are acting on or through a human being, but are cases in which a given human being has faculties which are not commonly possessed. Whether any given faculty, such as one of those now alluded to, shall grow, become common, and finally universal in the race, or wither and disappear, will depend upon the general laws of natural selection, and upon whether the possession of the nascent faculty is advantageous or not to the individual and to the race. But of infinitely more importance than telepathy and so-called spiritualism (no matter what explanation we give of these, or what their future is destined to be) is the final fact to be here touched upon. This is that superimposed upon self-consciousness, as is that faculty upon simple consciousness, a third and higher form of consciousness is at present making its appearance in our race. This higher form of consciousness, when it appears, occurs, as it must at the full maturity of the individual, at about the age of thirty-five, but almost always between the ages of thirty and forty. There have been occasional cases of it for 2,000 years and it is becoming more and more common. In fact, in all respects, as far as observed, it obeys the laws to which every nascent faculty is subject. Many more or less perfect examples of this new faculty exist in the world to-day, and it has been my privilege to know personally and to have had the opportunity of studying several men and women who have possessed it. In the course of a few more millenniums there should be born from the present human race a higher type of man possessing this higher consciousness. The new race, as it may well be called, would occupy, as toward us, a position such as that occupied by us toward the simple conscious alalus homo. The advent of this higher, better, and happier race would amply justify the long agony of its birth through the countless ages of our past. And it is the first article of my belief, some of the grounds of which I have endeavored to lay before you, that a race is in course of evolution."

HOW TO GO TO SLEEP.

At the recent meeting in Montreal of the British Medical Association, in the section of therapeutics, Dr. J. B. Learned, of Northampton, Mass., gave his experience with the many methods of inviting sleep without taking drugs. He detailed the positions of the body after retiring which he employed. He said the cause of delay in sleep coming is generally the brain running automatically without our consent, after we go to bed. He sets the brain to work at once on retiring—it is to direct the respiratory process. It is to count respirations to see that they are fewer in number, regular, deep, and somewhat protracted. In addition, certain groups of muscles are employed in routine order in silent contraction. By constant change other groups are brought into use. He has completed a systematized routine of contraction and relaxations. A slight elevation of the head from the pillow for a definite time by count of respirations is one of the many changes of position. All this is without any commotion, and need not be recognized by a sleeping companion. Brain and muscle and all parts of the body soon come into the normal state that precedes and invites sleep. A sense of fatigue soon overtakes one while thus employed, and before he is aware, the brain has forgotten its duty to regulate the breathing process, the muscles have ceased to expand to the call made upon them in the beginning, and sleep is in control of all the forces and all the organs. The details of this method of inviting sleep will not be the same for the strong and the weak. The principle, however, is one and the same, viz., the proper direction of vital energy to brain and muscle, according to the condition of the individual. The effect of brain and muscles combined, under direction of will, counteracts the one-sided automatic whirl of a little portion of gray matter that has come to antagonize normal sleep and to make night a source of gloom and unrest.

OUR NEW BOOK ON MAGIC.

Were it possible for Houdin, or Heller, or Herrmann, the great sleight-of-hand performers and professors of magic of a generation not yet past, to appear again upon the scene and enjoin the publication of this volume, as an infringement upon the rights and privileges of their confreres and successors, we do not doubt that they would promptly take most vigorous measures in such direction. So too, most likely, would be the disposition of the great majority of the jugglers and trick performers of all kinds, including not a few actors of some repute, who endeavor to cater to the public amusement by providing entertainments in which something more or less mysterious is introduced; for this book is the most complete exposé yet produced on the subject of magic and stage illusions. It is something unique in its way, in that the subject is treated on such broad lines and so exhaustively—being the first time, we believe, that so comprehensive a volume has ever been undertaken. In all explanations and descriptions of tricks and illusions, as one can readily understand, it is difficult to make the subject plain by mere words, no matter how exactly the details are gone over, but in this volume the great number of costly illustrations amply supplements the text, making it entirely clear how numerous illusions have been successfully presented to the public. The pictures not only afford views "behind the scenes," as it were, but take the reader into the workshop of the designer and mechanic, and expose at a glance the methods and means of producing what to the general public has been matter of wonder and astonishment.

The volume, edited by Mr. A. A. Hopkins, with the Introduction by Mr. Henry Ridgely Evans, is divided into five books, the first covering conjurors' tricks and stage illusions, comprising mysterious disappearances, optical tricks, miscellaneous stage tricks, conjuring tricks, jugglers' and acrobatic performances, fire eaters and sword tricks, ventriloquism and animated puppets, shadowgraphy, mental magic. Book II treats of ancient magic including temple tricks of the Greeks and their miracu, lous vessels, the origin of the steam engine, Greek lamps and toys, etc. Book III treats of science in the theater and Book IV of automata and curious toys.

In "Photographic Diversions," which forms the subject of Book V, a great deal of interesting matter is presented, never before brought together in book form, including especially a description of the method of taking and projecting moving photographs, as the vitascope, the cinematoscope and the mutograph. The chapter on trick photography comprises apparatus for taking silhouettes, artificial mirage, duplex photography, illusive and spirit photography, a multiple portrait, multiphotography, a photographic necktie, etc. On another page will be found an illustrated article taken from this work, and the formal announcement of the publishers appears in the advertising columns.

TRIPE AND ONIONS.

Scientific research has again knocked all the stuffing out of one of the most popular of gastronomic theories—namely, that the humble but appetizing tripe (with onions) was exceptionally digestible. Even Brillat-Savarin had not a soul above well dressed tripe for supper, mainly on the ground that it was at least "light" on the stomach—certainly much "lighter" than beef, mutton, or any other kind of meat. That theory must now be abandoned in the face of the conclusions to be drawn from extensive experiments carried out by Dr. P. Solomon, and published in statistical form by the United States Agricultural Department. The experiments were divided into two three-day periods. In the first period the diet consisted of tripe, bread, butter, and a little flour; in the second, an equivalent of meat was substituted for tripe, and in both instances beer was used as a beverage. The details of the chemical analyses cannot be entered upon. Suffice it to say that Dr. Solomon arrived at the conclusion that "in general there is no marked difference in the digestibility of tripe and meat."

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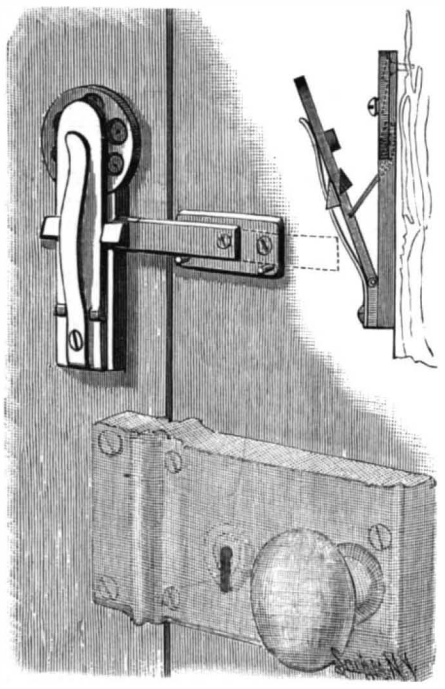
A NOVEL BURGLAR ALARM.

An alarm which may be used in connection with a door or window, exploding a cap on the unauthorized opening of either, is shown in the accompanying illustration, and has been patented by Clayton L. Knapp (address Mrs. Coralie J. Knapp, No. 104 West Ninety-second St., New York City). It is shown attached to a door, a plate secured upon the jamb having at one end a recessed portion, in which turns a disk or wheel having a number of pockets, each adapted to receive a cap, while in the back of the disk are ratchet teeth. Hinged on the front of the plate is a spring-pressed hammer carrying a firing pin or stud adapted to enter one of the pockets in the disk, as the latter is revolved by means of a dog engaging its ratchet teeth each time the hammer is carried outward. Pivoted upon a plate on the door is a trip bar, adapted to engage the under side of the projecting end of a cross bar on the hammer, so that, as the door is opened, the hammer will be gradually raised, as shown in the small view, until it slips off the end of the trip bar, such movement of the hammer revolving the disk to bring one of the cap pockets under the firing pin, and the hammer being forced down suddenly by the spring to explode the cap. The trip bar is supported in operative position by a pin, but it may be carried entirely out of engagement with the alarm device by turning it rearward, as indicated by the dotted lines. The free end of the trip bar has on its under side beveled surfaces, permitting it, when extended, to ride over a beveled surface on the end of the cross bar on the hammer, the trip bar then dropping to normal position, as shown in the principal view, and the alarm setting itself after a cap has been exploded and the door closed. The device can be applied to a door opening to the right or left, and a single alarm will protect both the upper and lower sash of a window.



KNAPP'S BURGLAR ALARM.

ACROSS ALASKAN PASSES.

The discovery of the Klondike gold fields has, of course, resulted in an awakened interest in Alaska, and there is hardly a magazine or a newspaper which has not been filled with either glowing accounts of the find or descriptions of the difficulties in reaching the new Eldorado.

Our engraving, for which we are indebted to Black and White, shows some of the hardships to which the traveler to the Yukon by the overland route is subjected. White Pass is the favorite, although it is fourteen miles longer than the Chilkoot route from Dyea. The former involves a climb of 2,650 feet, the latter one of 3,500 feet, part of which is so steep that it is almost impossible for a novice to carry a pack over it. The main drawback to the White Pass route is the long stretch of swamp which intervenes between the eastern base of the range and the lakes and it is almost impassable. Men have been employed to corduroy the road, which will make it more passable.

From Dyea the traveler traverses a three mile grove of cottonwood and then follows the river channel until Sheep Camp is reached. Here is quite a village of prospectors, who gather strength to climb the Pass. Above Sheep Camp the ascent is made by a narrow cañon barred with bowlders and sharp stones. The slope is so precipitous that at times the travelers have to follow the zigzag trail on all-fours. At last the cold summit is reached. It is almost impossible for even the stoutest Indian to carry more than 100 pounds up this slope, so that transportation is effected in installments. As the outfit of the miner is hardly ever less than from 500 to 1,000 pounds, it will be seen that the expense is great. No horse can be got over the Chilkoot Pass, and the cost of transporting goods over the Passes varies from $15 to $25 per hundred, the goods being delivered at Lake Bennett.

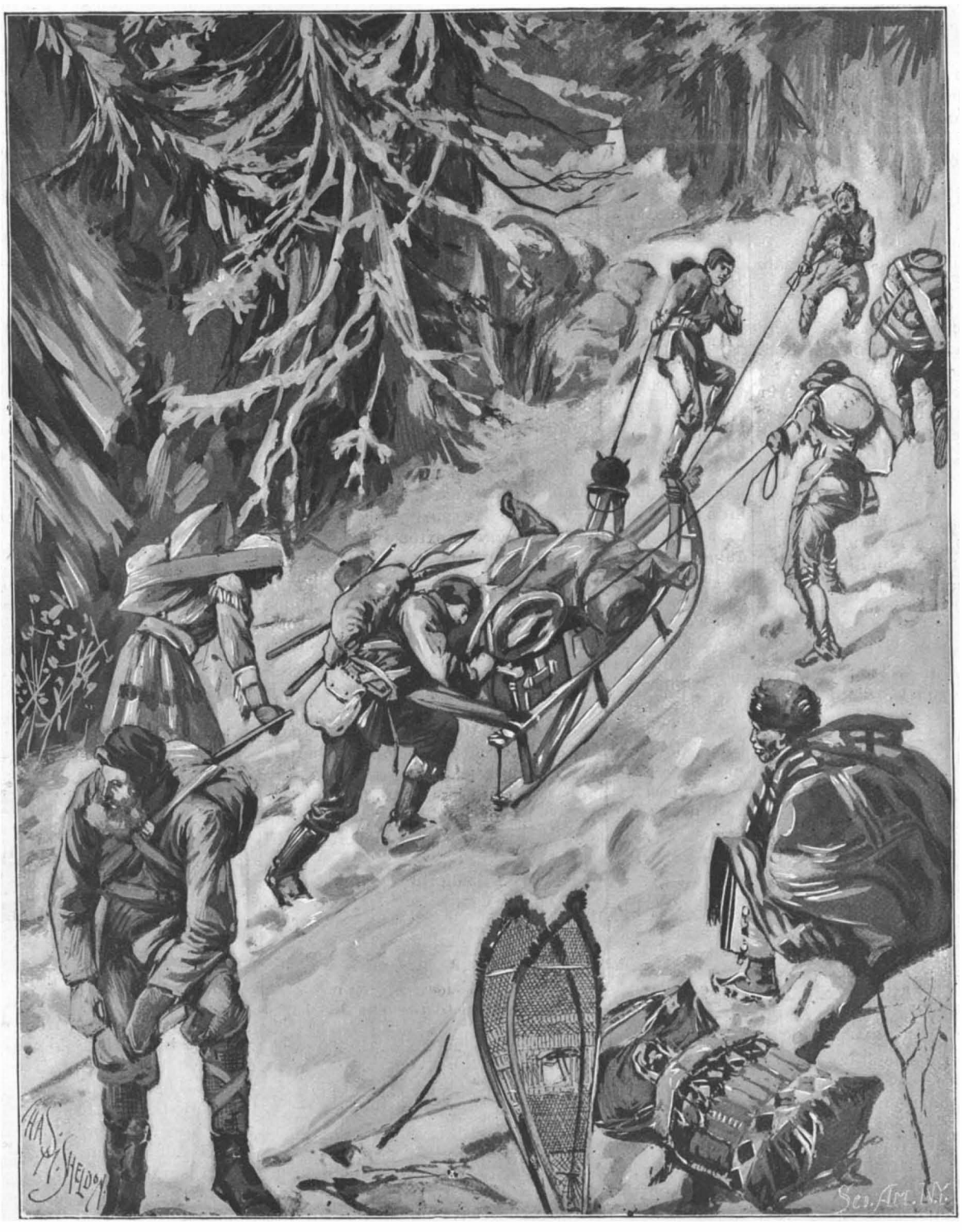
Once over the Pass the whole country is a succession of lakes, all connecting with each other by outlets which are often a succession of rapids.

On Lake Bennett is a saw mill which is busily engaged in sawing logs into boards for use in building the boats.

It is now easier to get from the lakes to Dawson than from the head of the Yukon to Juneau. The river waters run down, and there is in all the lakes a strong northerly and northeasterly current. Hence it is quite possible that the gold seekers may reach their destination more easily than they can send news of their fortunes to their friends. The mail does find its way from Fort Selkirk to Juneau, but it is a long time on the way, and in case of bad weather it is often delayed for several days at a time. At some of the rapids between the lakes boats have to be tracked.

On Lake Bennett many voyagers have followed Schwatka's example, and built rafts of the large birches which grow alongside the lake. At Lindeman scows or flat-bottomed barges are the fashion. They are built of soft white pine, and are generally about 24 feet long, 5½ feet beam, and 3½ feet deep. Such a vessel propelled by four oars and a single sail hoisted on a rickety mast is calculated to carry five passengers and two tons of goods. If it escapes shipwreck in the rapids, it will answer every purpose, and carry its occupants till they reach the Klondike or are stopped by the ice. Travelers who have found their way to Lake Bennett say that in ten days with good weather they will arrive at Dawson. If they do, they will be lucky. Still, the river is hardly blocked before the first week in October.

The accounts which have been given of the difficulties of reaching the gold fields by way of the Chilkoot Pass create an impression that the gold seeker carries his life in his hand, but the journey really involves no more perils and hardships than hundreds encounter every year in Canada, Maine, and Northern New York.



THE TRANSPORTATION OF BAGGAGE ACROSS THE CHILKOOT PASS.

How Weeds Are Distributed.

There is always a strife between the various plants and weeds as to which shall occupy the ground. Some plants crowd others out. Those producing great numbers of seeds will often occupy the ground against those which produce fewer seeds. Then, again, some plants, like the thistle or wild lettuce, scatter their seed to the four winds of heaven, while the seed of the yellow dock is dropped close to the parent stock. Weed seeds are scattered with wheat, grass, clover, and other grains. Some of our worst weeds have been brought into this country in shipments of cheap clover and other seeds. And, right here, permit me to remark, Congress ought to prohibit the importation of cheap and worthless seed from foreign lands, and the legislature ought to forbid the many fake seed houses in this country from shipping into Ohio, unless first tested. Weed seeds are carried and transplanted by birds and animals, by the wind, by currents of water down streams and ditches, along highways and along railroad right of ways. They are sometimes planted by foolish persons, and thus a start given them so that others may be afflicted. Old fence rows furnish a steady and undiminished supply of weed seeds and so do old abandoned corners and uncultivated lots.

The railroad right of ways are the means of furnishing the farmer an inexhaustible supply of obnoxious weed seed; the right of ways being long narrow strips of land adjacent to so many different farms, will soon seed such adjacent premises. The weeds are often permitted to grow on the right of ways until they go to seed. The numerous trains carrying live stock seed the right of ways from one end to the other. This is demonstrated by the great variety of weeds growing around Chicago, where so many railroads center.—Hon. D. J. Cable, in paper read before Farmers' Institute, Harrod, Ohio.

LUCIEN BIART, who died recently, was a talented author, and although he chose to veil his scientific knowledge in the form of novels, that knowledge was incontestable, says Natural Science. A great love of travel took him, in 1845, to Mexico, where he studied archæology and ethnography. In addition to his novels, the chief of which are "Le Roi des Prairies," "Entre deux Océans," etc., he wrote a volume on the red races for the Bibliothèque Ethnologique, as well as a monograph on the Aztecs.

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THE SAVAGE RIFLE—SMOKELESS POWDER AND EXPANDING BULLETS.

The deadly effect upon game of small metal-covered expanding bullets, with high velocity smokeless powder, has been recently satisfactorily demonstrated with a 0·303 caliber Savage rifle, using cartridges with a 0·303 soft nose expanding bullet. The rifle and cartridge are manufactured by the Savage Repeating Arms Company, of Utica, N. Y. The flight of the bullet was 2,000 feet per second. Modern 0·303 weapons possess several important advantages over the old large calibers in flatness of trajectory, absence of smoke, long range, increased penetration, high velocity, less recoil, and light weight ammunition.

The expanding bullet is a big game projectile. It invariably expands with an area of laceration greater than ever produced by any projectile before used. Without calculating the effect of the nervous shock, it is easy to see from the accompanying illustrations that immense splintering and laceration was produced. The largest game in the world, the royal Bengal tiger of India, the elephant and rhinoceros of Central Africa, are now being successfully hunted and slain by sportsmen using the 0·303 caliber rifle. Sportsmen who have never tried the small caliber rifles and smokeless powder ammunition are somewhat skeptical as regards the killing or stopping power of small metal-covered expanding bullets. The secret of the deadly effect of these small projectiles lies in their expanding qualities and extraordinary high velocity, which impart a percentage of energy to the otherwise inert flesh and bone; and these substances being acted upon by so quick a blow become themselves projectiles, lacerating the surrounding tissues and bone. The high velocity resulting from the use of smokeless powder is only possible when confined by small calibers. If a bullet is omitted from one of these cartridges and the primer struck, no explosion of the powder will occur. The rapid twist of the rifling and the great pressure of smokeless powder compels the use of some less yielding metal than lead, as a soft lead bullet would strip and be blown directly out of the barrel.

The difference in the weight of one grain of smokeless powder adds considerably to the pressure. The two accompanying figures represent the expanding bullet before and after being fired. This bullet weighs 185 grains. The metal covering is made of a soft light metal which does not injure or wear the rifling of rifle barrels. Extremely high velocity is attained by the comparatively slow combustion of smokeless powder, which continues its expelling action, accelerating the speed of the projectile until it leaves the muzzle of the gun. In the accompanying exhibit the bone and tissue were literally pulverized by the missile. These bullets, when they strike, spread, tearing and cutting in all directions.

WOUNDS CAUSED BY SMOKELESS POWDER AND EXPANDING BULLETS

Improved New York Postal Service.

The improvements in progress and contemplated in the United States postal service at the great New York office, and which have been actively promoted by the Postmaster-General during his recent visit, bid fair to make the postal business at this populous and busy center one of ideal excellence. The pneumatic tube system which is to connect the main office with Brooklyn, the Grand Central station, and the Produce Exchange is being rapidly pushed forward, the six pipes connecting therewith entering the wall of the Federal building at the corner of Park Row and Mail Street. It has been arranged that the compressed air necessary to operate the system will be furnished by the dynamos of the new electric plant recently established in the building. As the New York office, large as it is, has long been greatly embarrassed for room, arrangements have been made for gaining considerable space for the accommodation of mail wagons on the north side of the building; but of more importance still are the plans by which it is being provided that incoming mails, to be dispatched abroad by steamship, shall be assorted for their several destinations on the trains by which they arrive, thus relieving the New York office of a vast amount of work, and the extra handling of great quantities of mail matter, as well as promoting quick dispatch. Another improvement, which will be particularly agreeable to all travelers arriving from abroad, has also been planned.

Heretofore letters addressed to passengers on incoming steamers, which sometimes form a large mail, have been put in the hands of the consignees of the vessels, and so have not been received by those to whom they were addressed until after the vessels arrived at their docks. Instead of this method, it is now proposed to send this mail down the harbor to meet the steamers as they come in, employing therefor the boats that take the incoming mails from the steamers at quarantine. In this way the pursers will be able to sort and deliver mail matter to the incoming passengers aboard the steamers—a delivery which would generally be some hours in advance of that now accomplished after landing, affording a most signal convenience to the passengers. People are never so hungry for greetings from their friends or news of what is going on in the world as on arriving in port from an ocean voyage, and the contemplated improvement cannot fail, therefore, to be correspondingly appreciated.

Automobile Vehicles in Warfare.

In an article discussing the above subject in La Revue Technique. Col. Fix examines the requirements and conditions which must be met in order to achieve success.

Since all military vehicles must be both solid and simple, many features which might be otherwise acceptable must be omitted, says the Engineering Magazine. Roads which in time of peace are good soon become neglected and demoralized in time of war, and a vehicle, like a soldier, should be able to accommodate itself to all inconveniences. Tires of rubber, whether pneumatic or solid, are inadmissible, both because of the greater weight to be carried and because of the rough usage to be endured. Iron tires alone meet the requirements, and, in view of the great torsional strains, the hubs should be larger than they would otherwise need to be, while, in order to clear surface obstacles, the diameter of the wheels should not be less than that now found in field artillery.

Electricity is barred as a motive power, on account of the impracticability of charging accumulators in the field or en route, and steam or petroleum motors alone remain, between these steam having the preference, at least for greater powers, since the petroleum motors at present are not satisfactory above ten horse power.

Practically an automobile vehicle for military service must be a carefully designed steam traction engine. planned to haul artillery and supply trains anywhere where horses can go; the questions of speed and personal comfort, so important in pleasure vehicles, need hardly be considered.

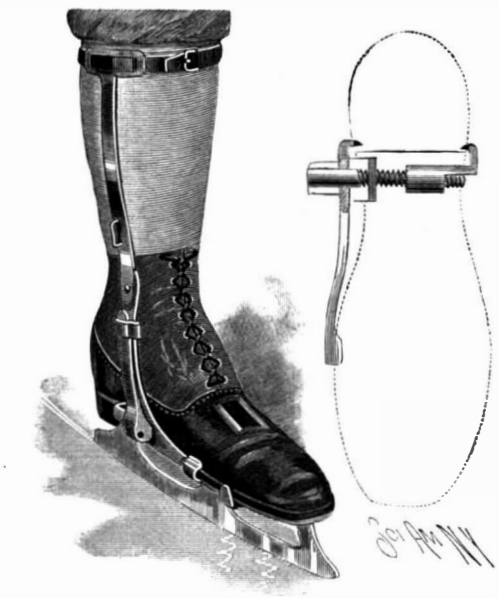
Col. Fix shows some very interesting figures relating to the cost of horses in military service, and makes out a strong case for the side of the machine, and it is not at all unlikely that the use of machinery in warfare may soon enter the field service as extensively as it has already entered other departments.

Recovery of a Body on Mont Blanc.

In October, 1866, Captain Henry Arkwright, the guide Michel Simond and two porters, François and Joseph Tournier, were killed by an avalanche on the Grand Plateau of Mont Blanc. The bodies of the guide and the porters were found a week after the accident, but that of Captain Arkwright was only found last month. The entire body was recovered. with the exception of the head and feet. The right hand was marvelously lifelike. The ice had preserved in it the red tint of the blood. He was found with all his jewels and white handkerchief in his pocket with his name on it. An inquest was held on the remains and they will probably be buried at Chamounix. The body was recovered 9,000 feet below where he was killed thirty-one years ago.

AN ANKLE BRACE FOR SKATERS.

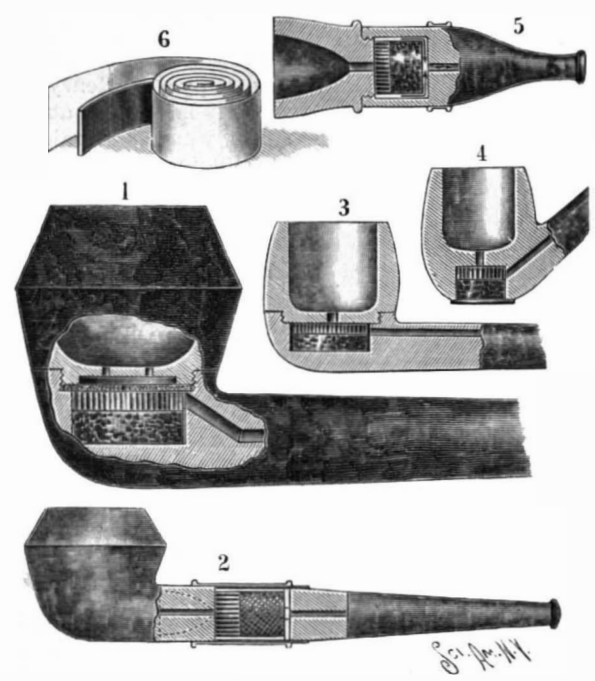
The illustration represents a device designed not only as a support for weak ankles, but to prevent the tiring of the ankle during long exercise in skating, while it is also intended to give the skater better control over the skates. The improvement has been patented by Carl Engberg, of St. Joseph, Mich. The device is applied on the inside of the foot, and has an upper section made fast by straps, to which is pivoted a lower section having an integral arm extending alongside of the sole, the arm having at its forward end a jaw adapted to clamp the edge of the sole, while its rear end terminates in a claw adapted to engage the side surface of the heel, as may be seen in the outline view. The arm forms virtually a clamping arm, in connection with a screw passed through a bracket at its bottom, and entering an opposite threaded bore in a sleeve which terminates at its outer end in a claw. Pivoted to the head of the screw is an adjusting arm having at its lower end a cam surface, and after this arm has been turned to effect a ready engagement of the claws with the sides of the heel its outer end is carried up against the lower section of the shank and secured in such position by a sliding loop or equivalent device, the cam surface then engaging the clamping arm to hold the claws firmly in engagement with the heel. The device being applied on the inside of the foot, its presence is not especiall noticeable.



ENGBERG'S ANKLE BRACE FOR SKATERS.

A NICOTINE ABSORBING, SMOKE COOLING PIPE.

To prevent nicotine and other unhealthy substances from passing to the mouthpiece of a pipe when one is smoking, and also to cool the smoke as it passes through the pipe, with the view of rendering smoking more pleasant and innocuous, the improvement represented in the accompanying illustration has been patented by William S. Hannaford, of Pasadena, Cal. Fig. 1 is a sectional side elevation of the pipe, of which Figs. 2, 3 and 4 are modifications. As shown Fig. 1, the bowl is adapted to be screwed to the enlarged end or sub-bowl of the stem, and in the bottom of the bowl are smoke outlets terminating in a recess covered by blotting paper or similar material, this cover closing the top of a spiral passage connected at its middle with a central opening in the cover. The outer end of the passage connects with the inner end of the bore in the stem, and the under side of the spiral passage rests on an absorbing pad. By unscrewing the bowl, the cover and the absorbing material may be renewed from time to time to keep the pipe always in a fresh condition. In Fig. 2 the coil or spiral passage and absorbing wad are shown arranged in the stem of the pipe, there being nine inches of smoke passage in the coil, and the stem being also suitable for use as a cigar holder, although a special arrangement for a cigar holder is shown in Fig 5. Figs. 3 and 4 represent a pipe filled from above and from below, in the former case the bowl unscrewing and in the latter case a metal shell sliding out below.



HANNAFORD'S TOBACCO PIPE.

Fig. 6 represents a combination coil and wad made by rolling up two strips of paper, one being thin and half an inch wide and the other blotting paper five-sixteenths of an inch wide, the arrangement in either case affording a long spiral path for the smoke in a comparatively small space, and the smoke in its travel depositing nicotine and other impurities.

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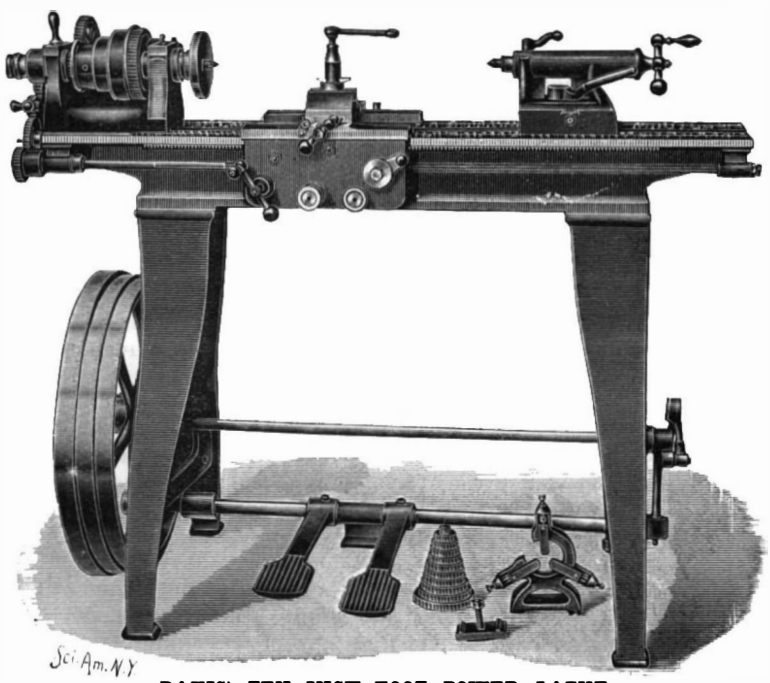
The New Southampton Record.

It is a matter for national pride that both the westward and eastward record between Southampton and New York are now held by American-built ships. The St. Paul has held the westward record for more than a year, and the St. Louis has now broken the eastward record by the trip ending at Southampton on September 8, the time of passage to the Needles being six days, ten hours and fourteen minutes. The record of the Hamburg line steamship Fuerst Bismarck, which was held since September, 1893, was lowered by forty-one minutes, and the St. Louis broke her own best previous record by one hour and sixteen minutes. What is particularly gratifying is that the American ships have been taking away the records from the German ships which were based upon Clyde-built models, and it all goes to prove that it is no fault of our shipbuilders that we have not long ago regained the maritime position which we held some forty years ago when our tonnage was almost that of Great Britain.

AN IMPROVED LATHE.

The accompanying illustration represents a ten inch foot power engine lathe, which when desired is also furnished with a countershaft for power. It differs from other lathes of its class in that it is much heavier in design, and great care has been taken to secure the utmost strength for the amount of material used. It is manufactured by the W. P. Davis Machine Company, Rochester, N. Y., and is strictly a high grade lathe in every particular. The following dimensions will assist in determining the relative strength and driving power of the tool. Front bearing, 2¾ inches long, 1½ inches in diameter; back bearing, 1⅞ inches long, 1¼ inches in diameter; nose of spindle, 1½ inches in diameter, 10 threads to the inch. Hole in spindle 9 16 inch, conforms to Morse taper. Swings over ways 10¼ inches; swings over rest 7 inches; distance between centers, 32½ inches. Cone has three sections: 3¼, 4⅜, 5½, face 1⅜. Ratio of back bearing, 7½ to 1.



DAVIS' TEN INCH FOOT POWER LATHE.

The Origin of the Weather Bureau.*

BY PROF. CLEVELAND ABBE.

The writer well remembers the day when, as a youth, over forty years ago, he visited Merriam, "the Sage of Brooklyn Heights," whose publications had awakened his attention to the possibility of publishing reliable daily weather predictions.

In those days the New York evening papers printed a daily weather bulletin, furnished by the enterprise of the telegraph companies, which gave the temperature, wind and weather for some early morning hour at a large number of stations scattered over the whole country. Had these items been displayed graphically upon a map of the country, it would have been possible to practice daily forecasting for New York; but as this was not done by the newspapers, the readers probably picked out only a few interesting temperatures as items of news, and never realized how nearly they had in their grasp the power of predicting the weather. But I suspect that this daily charting is precisely what Merriam may have privately done, and on which he may have based his occasional public predictions of "heated terms" and "cold terms."

If those telegrams had contained the readings of the barometer in addition to the other items, and if Merriam had charted them, as Espy and Henry were then doing, he would undoubtedly have been able to add also the prediction of storm winds and rain. If Merriam's manuscripts are still in existence, they would afford valuable material for a history of meteorology in America. An old scrapbook of mine, begun in the year 1851, still reminds me of my vivid interest in the prediction of the weather by rational methods. It was not until ten years later that I realized that this daily telegraphic bulletin in the New York newspapers was directly due to Prof. Joseph Henry, who in 1849 had asked that these weather items be telegraphed for the use of the Smithsonian Institution, in order that he and Espy might study the origin, development and progress of American storms. From 1842 to 1857 James P. Espy was the official meteorologist of the United States, and carried on his work in co-operation with the army, the navy and the Smithsonian.

No man ever had a broader appreciation of science for its own sake, and also of science as a means of benefiting mankind, than Prof. Jeseph Henry, the noble-hearted first secretary and organizer of the Smithsonian. His natural gifts and his scientific researches were well known before he was elevated to this position, of whose duties and responsibilities he entertained the most exalted conception, and to which he was faithful to the last.

There is scarcely a branch of practical or applied science that he was not able to advance; among these telegraphy and meteorology, with their applications to the benefit of mankind, stand pre-eminent. In 1848 Redfield, of New York, Loomis, then of the Western Reserve College at Hudson, O., and Espy, of Philadelphia, were the leaders in the study of storms. Henry was the friend of all, and indorsed and advanced their views. The telegraph companies, recognizing and acknowledging their indebtedness to him for his discoveries and inventions in electrical matters, granted him freely those daily weather dispatches that he asked for and which enabled him to be the first to demonstrate systematically the truth that Redfield, Espy and Loomis had long maintained; i. e., that through the telegraph, although then in its infancy, we had the power to predict the coming storms. The Morse telegraph line was open for public business in April, 1845, and in 1846 Redfield published his conviction of the probable value of the telegraph and the daily chart; it is on record that merchants in New York, Boston and Cincinnati, in their individual capacities, were often guided by weather reports telegraphed from a few neighboring stations. But systematic and public work for the benefit of all was the object that Henry had in view. To this end a daily telegraph bulletin was compiled at his request, and was communicated both to the Smithsonian and to the daily press. To this end he immediately displayed this same data daily on a map at the Smithsonian Institution. To this end he constantly interviewed members of Congress as to the propriety and the necessity of a public weather service, illustrating his talk by actual predictions for Washington. To this end finally, in 1864, he was preparing to revive his map, which had been temporarily discontinued during the war, when a disastrous fire in the Smithsonian building checked all further work in this direction. But Henry's agitation of the importance of the subject did not cease, as is shown by the testimony of several members of Congress whom he interested in the subject. Meanwhile, England, Holland and France had awakened to the possibilities of the case.

Owing to the labor of Espy, Redfield, Loomis and Henry, there was widespread throughout this country a conviction that something useful could be done in the way of weather predictions. When the writer proposed the subject in May, 1868, first to the trustees of the Cincinnati Observatory, then to Mr. John A. Gano, as editor of the Cincinnati Commercial, subsequently again to him as president of the Chamber of Commerce, there was an immediate response to the effect that "this is what we have long been doing for our individual business interests and will be glad to have you do for the city as a whole." When, in August, 1869, on behalf of Cincinnati, he made a similar proposition to the Chicago Board of Trade looking to co-operation, there was a temporary difficulty in accepting it; but an editorial in the Chicago Evening Journal called public attention to the nature and importance of the work, and "The Weather Bulletin of the Cincinnati Observatory" began September 1, 1869. When in December, 1869, Prof. I. A. Lapham's memorial to the Academy of Sciences was, by the Hon. E. D. Holton, converted into a memorial to the National Board of Trade, and by the Hon. H. E. Paine into a memorial to the Senate and House of Representatives at Washington, there was from each an immediate favorable response. Prof. Henry was at hand to say that from a scientific point of view the scheme was thoroughly sound; the representatives from Ohio were at hand to say that the work was being successfully done in Cincinnati; Gen. Myer was on hand to say that the Army Signal Corps were ready to carry out the practical part of the great national work. Thus Mr. Paine's bill was rapidly forwarded through the various stages of legislation, and the act of February 4, 1870, accomplished the great object that had been held steadily in view for forty years by Henry and his co-laborers—a national weather bureau was established; another department of science was recognized as of eminent utility.

During the past twenty-seven years the American public, and for that matter the world at large, has with increasing admiration, viewed the energy, the accuracy and the practical value of the work of the Weather Bureau. Those who admire climatology as well as those theoretical students who deal with the difficult mechanical problems involved in meteorology have sometimes felt that the bureau pays too little attention to scientific investigations, and that many nice points are lost sight of in the breadth of the work and the rapidity of execution that has always been imposed on us by the public and by our successive chiefs.

But, whatever reason there may have been for this criticism, it is likely to be removed if the plans of our present chief are allowed to come to full fruition. The fact is that meteorology, considered as the scientific study of the laws of atmospheric phenomena, is not yet in a perfectly satisfactory position. This is not to be wondered at when we recall that, in 1870, Ferrel was the only man who possessed clear views of the mechanical problems involved in the movements of the winds.

His work was broad and general, and it was necessary to collect more facts before attempting any future developments in unraveling the mechanics of the atmosphere. Since those days our knowledge of the laws of mechanics and thermodynamics, as applied to the air, have been advanced by the study of skillful mathematicians and physicists. Simultaneously with their work, the publication of daily weather charts, and the exploration of the air by means of high mountain observatories and by balloons and kites and the spectroscope, has given us such a solid observational basis that we can now begin to handle the problems of nature in a manner that promises partially to satisfy the demands of exact science.

If our universities would give dynamic meteorology a prominent place in their courses of study, it would greatly facilitate our future progress and the development of a new race of students. In the matter of observations, the most desirable improvement is the invention of some method by which to ascertain the actual condition of the air as to pressure, temperature and moisture at a considerable height above the ground. When Prof. Moore shall be able to realize his ideal of obtaining, at any moment, the wind and temperature from any altitude up to two miles by means of kites or other devices, we hope to have a satisfactory solution of this problem, and shall be able to apply the recent development of mechanical ideas to comprehensive studies of the atmosphere.

Luminous Photographs.

These photographs, according to J. A. Randall, in an article on "The Magic and Mystery of Photography," published in the American Journal of Photography, were first introduced at a ball in Vienna, where programmes were decorated with a luminous picture representing an alchemist at work. "There are several ways of making luminous photographs, the simplest being that of W. B. Woodbury. A sheet of cardboard is coated with a luminous paint and exposed to light under a glass positive or transparency. On removing the cardboard to a dark room a striking and brilliant phosphorescent image is seen, with all the gradations of the positive. The effect may also be produced by arranging a series of glass tubes containing a phosphorescent substance behind a thin glass positive. On exposure to light the luminosity of the tubes will shine through the positive in proportion to its density. When viewed in the dark, a glowing image is the result.

"Another method, which can be applied to an ordinary print on thin paper, is as follows: Take a sheet of cardboard and spread over it as evenly as possible a thin coating of starch paste; when still tacky, dust over it an even layer of powdered calcium or barium sulphide, rubbing it well over with a brush to make it adhere in every part. Then take the print, which should be light, and fixed and toned as usual, and saturate it with a mixture of castor oil and oil of turpentine, taking off all excess with a clean rag. The print, thus made semitransparent, is next pasted upon the prepared cardboard, and the whole well dried before the fire. A print thus prepared, when exposed to light, receives the rays on the phosphorescent sulphide beneath, which becomes luminous in proportion to the absorption which has taken place; it is, therefore, luminous in the dark by the light transmitted. A silver print is soon destroyed by this process, for the sulphide attacks the image. It can be applied to the carbon or other processes not having silver as a basis. Moonlight pictures and landscapes give the most striking effects as luminous photographs."

* The Independent.

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Correspondence.

Inventor of the Gimlet Screw?

To the Editor of the SCIENTIFIC AMERICAN:

We have read with much interest the sketch in your issue of August 28 of Hayward Augustus Harvey, and while we do not wish to appear hypercritical, and have no desire to detract in the slightest from the merits of the Harveys, yet, as the article purports to be original, we think that, for your own credit and for historical accuracy, one or two statements therein should be corrected.

For instance, you state (referring to Gen. Thomas W. Harvey) "he was the inventor of the gimlet pointed screw," the fact in this particular case being that the inventor is not known; for, as we have stated in previous communications which have been published, gimlet pointed screws were undoubtedly made as early as 1755, for in September, 1879, there was exhibited at the Worcester, Mass., musical festival a piano inscribed "Jacobus Kirckman, Fecit, Londini, 1755," and numerous gimlet pointed screws were taken from this instrument, apparently inserted when the piano was originally constructed.

In a work entitled "Recueil de Planches sur les Sciences et les Arts Liberaux et les Arts Mécaniques," Paris, 1771 (Plate 7, Fig. 7, Planche 9), is an illustration of a screw with beveled nicked head and tapering shank threaded to the point.

The drawing of the slotted head cold rolled screw which you illustrate is misleading, as the cut shows a head sufficiently enlarged to correspond to the diameter of standard thread; the fact in the case being that this enlarged head on the comparatively small sized wire was made commercially possible only through the inventions of Mr. Charles D. Rogers.

The work performed by Mr. H. A. Harvey in rolling threads was the use of a series of three cylindrical dies or rolls for developing a thread of sufficient depth to be used for wood screw purposes in place of flat dies, which had for many years previous been employed in Connecticut and elsewhere for the rolling of machine screw threads. For these three cylindrical dies or rolls he finally substituted a single roll having the grooves and ribs on its surface, but the use of this invention has been abandoned. OLNEY ARNOLD (second),

Secretary American Screw Company.

Providence, R. I.

Andree's Balloon Expedition.

To the Editor of the SCIENTIFIC AMERICAN:

In this journal for September 4, page 150, there is a quotation from a letter written by Dr. Nils Ekholm to a Swedish paper. There are one or two errors in this paper which should not pass unnoticed. The balloon could not possibly have risen to 25,000 feet, as this would have required throwing off several tons of ballast. French journals just arrived give full accounts of the launch of the balloon. The original balloon, of 68 feet diameter and containing 162,000 cubic feet, was enlarged last winter by putting in a strip 37·5 inches wide around the equator. This enlarged the capacity to 180,000 cubic feet. At the first the loss of gas was 890 cubic feet a day, or one-half per cent. Owing to necessary repairs and unavoidable punctures, however, the loss of gas at the start amounted to 1,770 cubic feet a day, or one per cent. This does not seem excessive, though double what had been anticipated.

Dr. Ekholm gives the balloon a voyage of from 22 to 24 days, but it is not easy to understand his computation. The lifting power of the balloon was over 12,000 pounds. The total weight of the balloon and necessary cordage ought not to have been much over 2,000 pounds, and the three men would weigh 500 pounds. This would give over 75 days' flotation. It is probable that Dr. Ekholm has computed in the weight of the car, instruments, steering apparatus, etc. It is customary to calculate everything movable as ballast to be used in an emergency, the voyagers finally clinging to the ring of the balloon. In many cases a disabled balloon has been able to keep afloat, even after it touches ground or water, for the release of a part of the weight by touching keeps the balloon going.

The start of the Eagle was Sunday, July 11, at 14:35 hours. Its first bound was to a height of 330 feet, but immediately after there was a drop, owing to a recoil, little understood at present, which almost invariably attends an ascension in a high wind. Andrée at once threw off 460 pounds ballast (estimated probably from the bags of sand emptied). This left him only 880 pounds of sand ballast, as most of the ballast consisted of food and ropes. The balloon at once rose to about 2,600 feet, just clearing Vogelsang Island. The balloon was visible over an hour and presented a beautiful sight as it sailed away toward a point a little north of Franz Josef Land, or about where the intrepid Nansen boldly left his steamer Fram to push as far north as possible.

There is not the slightest doubt that, under proper auspices and with a full comprehension of the problem, a balloon voyage can be made to the pole, and this too with much less hazard than is ordinarily thought. It is a significant fact that, notwithstanding the extreme doubt of the safety of Andrée, the French are already planning a second attempt to reach the north pole by balloon. There should be a thorough study of the problem of releasing a balloon in a high wind and of overcoming the peculiar recoil. It would be a grand thing if the balloon could be brought to this country and a voyage be made to Europe. This would be in the track of numerous steamers and the least untoward event would not be absolutely fatal, as it is likely to be in the Andrée voyage. Such a trip would serve to give one perfect confidence in the power of the balloon and would also give invaluable experience in managing a balloon in a long voyage.

Above all, efforts should be primarily directed toward maintaining the balloon at an altitude of 6,000 feet or so. It ought to be just as easy to do this as to keep it at a lower level. If a smaller balloon has its neck connected with the larger, the overflow can be caught by it, and after enough gas has leaked from the large balloon, the smaller could be emptied into it and it would then serve as ballast in an emergency. At 6,000 feet the currents of air are about three times as rapid as at the earth, and they are far more constant. It has been demonstrated that practically the same distribution of pressure in highs and lows occurs at the pole as in lower latitudes; hence any current setting strongly to the north would be likely to accomplish the object. Paradoxical as it may seem, any wind near the pole is a favoring one to take one there and the same wind (in fact, wind at the pole) is a favoring one to bring one back.

At the height of 6,000 feet there would be far less danger of rain and fog freezing on the balloon—a circumstance that would be practically fatal. At 6,000 feet the precipitation, if any, would be rarer, which could be swept off, but this would be impossible with ice or frozen sleet. It is not generally known that this country holds the record for a long distance voyage. La Mountain and three companions, on July 1, 1859, sailed from St. Louis, Mo., and landed in Henderson, N. Y., 870 miles in 19 hours. Most of the voyage was at about 7,000 feet, and it is certain that no such record could have ever been made at a much less height.

H. A. HAZEN.

Washington, D. C., September 3, 1897.

The Production of Large Artificial Diamonds.

Consul Germain, of Zurich, says: Diamonds of a very small size have been produced artificially heretofore, but no one has as yet succeeded in producing large ones. Mr. E. Moyat claims to have discovered a new process by which to produce diamonds of large dimensions. In principle, his process is about the same as the one already invented by others, and that is to obtain crystallized carbon out of iron and coal, by means of high pressure and high temperature. Yet there is some improvement in the Moyat process as regards the technical operation. Pulverized coal, iron chips, and liquid carbonic acid are placed in a steel tube and hermetically sealed. The contents are then subjected to the action of an electric arc light by means of two electrodes introduced into the tube. The iron liquefies, is then saturated by part of the pulverized coal, at the same time the liquid carbonic acid evaporates, thereby creating an enormous pressure on the mixture of iron and coal. This pressure again considerably increases the dissolution of the coal in the liquid iron. While the mixture is cooling, the carbon crystallizes partly in the form of real diamonds and partly in the form of similar stones. These crystals are then segregated by dissolving the iron in diluted muriatic acid. The mixture, by the above method, remains under high pressure during the operation of the electric current, while by other methods the pressure is obtained later on only by means of the rapid cooling process of the crucible.

Asiatic and African Explorations in 1896.

The long list of geographical explorations accomplished during 1896 includes, says the Popular Science Monthly, the exploration of a large region pertaining to the upper Yang-tse-Kiang River, Chinese empire, by M. Bonin, a French officer in Tonkin, who visited countries not previously traversed by Europeans, and has been able to make important corrections in the map of the Yang-tse-Kiang and its tributaries. Dr. Sven Hedin, in exploring the Takla Makan, a continuation of the Desert of Gobi, has found the ruins of two of the towns said to be partly buried in the desert, and has made interesting investigations on the past and present hydrography of the Lob Nor region. M. D. Kiements, sent out by the Siberian Geographical Society to the Khengai Mountains of northwest Mongolia, found a great glacier on the western slope of the mountain, and everywhere signs of former volcanic activity. A Russian expedition has been exploring the course of the Amu Daria, with a view to ascertaining if it would be possible to divert its waters by means of a canal into the Caspian Sea. The exploration of Asia Minor, predominantly archæological, has been continued by young men of the University of Oxford.

Science Notes.

The largest known flower is said to be the Raffiesia, of Sumatra, whose diameter is nine feet, and which smells like a piece of putrid beef.

On July 8 the Geographical Institute of Lisbon, founded in commemoration of the four hundredth anniversary of Vasco da Gama's departure for the Indies, was opened by the Geological Society of Portugal, says Natural Science.

Paris barbers and hairdressers are now obliged by the police to take sanitary measures in carrying on their business. Elaborate regulations have been sent out requiring them to use only nickel-plated combs, to substitute pulverizers for powder puffs, to cover the hair cut off with sawdust and have it removed at once, to wash their hands before working on a customer, and to place all metallic instruments, razors, shears, combs, cutting machines, etc., in a solution of soap and boiling water for ten minutes before they are used.

The city of Breslau recently consulted the chemists of the university respecting some old manuscripts of the sixteenth century, which damp and old age had made quite illegible in some parts. A remedy was very easily found. It was ascertained that gall nut ink had been used, as had been expected. When painted with a one per cent alcoholic solution of tannic acid, the characters became at once fairly discernible. Ammonium sulphide brought them out again in full distinctness. This is the well-known cure, which once more has proved reliable.

William Pierson, San Francisco, donor of the Pierson photographic lens to the Chabot Observatory in Oakland, has offered to bear the expense of sending Prof. Charles Burkhalter, astronomer in charge of the observatory, to India to take observations of the solar eclipse next spring. The Board of Education decided recently to grant Prof. Burkhalter leave of absence from October until May 1 with full pay. Prof. Burkhalter confided to friends that, had the leave not been granted, he would have handed in his resignation. He is particularly anxious to observe the eclipse, as he has invented an appliance for use in astronomical work which he wishes to test, and from which he expects great results.

Emperor Francis Joseph, of Austriá, has given his consent to the union of the two great imperial libraries at Vienna, the Hofbibliothek and the Kaiserliche Familienfideicommisbibliothek. The step is taken in order to do away with the purchase of duplicate books, but one result will be the throwing open to students of the private family library, which hitherto has been reserved for the use of members of the imperial household. The library is noted for its enormous collection of portraits as it includes the collection begun by Archduke Francis, of Tuscany, in 1784, which now contains 90,000 portraits, 22,000 engravings from the collection of Lavater, the physiognomist, and 100,000 portraits detached from printed books.

From a series of investigations on the effect of cutaneous excitations on the formation of red blood corpuscles, Prof. H. Kronecker and Dr. A. Marti, writing in the Atti dei Lincei, draw the following conclusions: (1) Feeble irritations of the skin promote the formation of red blood corpuscles, but modify the formation of hemoglobin in different ways. (2) Strong irritations of the skin determine a diminution of the number of red corpuscles, and, in a minor degree, of the hemoglobin contained in the blood. (3) Darkness diminishes the number of blood cells; after about a fortnight, a minimum is reached, which is followed by a limited increase. (4) Continued exposure to intense light (even at night with electric light) induces the formation of red blood corpuscles, and also, in a lesser degree, of hemoglobin.

The State of Indiana has undertaken to defray the expense of publishing annually the Proceedings of the Indiana Academy of Science, and the two reports, for the years 1894 and 1895, for the printing and publication of which the State has paid, have just come to hand, says Nature. By publishing the proceedings of the Academy the State secures, without further expenditure, the service of a number of investigators working in various departments of science, and spending a large portion of their time upon new problems the solution of which is of importance to the development of the Indiana commonwealth. These investigators, who constitute the best authority in the State upon their several subjects, will act without pecuniary compensation with the legislative body of Indiana, just as the National Academy of Sciences acts in conjunction with the United States Congress. They will freely advise the legislators when consulted upon scientific subjects, and assist in giving direction to scientific investigations undertaken by the Legislature as a basis for logical laws. The work of an academy like the Indiana Academy is an important factor in developing mineral, vegetable and animal resources, and it greatly strengthens educational agencies. The State has thus acted wisely in giving encouragement to the scientific workers within its borders, and doubtless the funds it has undertaken to provide will be returned a thousandfold.

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COMPLETION OF PART OF THE BOSTON SUBWAY.

Some years ago the horse car system of the city of Boston was converted into a trolley system and now the city is traversed in all directions by electric cars, and the combined routes of various companies serve almost the entire suburban district as well as the city proper. After the introduction of the trolley, it soon became apparent that Boston required additional facilities for the transportation of street car passengers to the lower parts of the city. It was found that the problem of rapid transit was not solved by the trolley, owing to the overcrowding of traffic at certain points. The wholesale introduction of the trolley did not tend to improve the appearance of the handsome city, and the wires were particularly objectionable on Boylston and Tremont Streets, where they ran at the side of the Public Garden and the Common. The congestion of traffic on these two streets was very bad, and at times a solid line of cars made travel well nigh impossible.

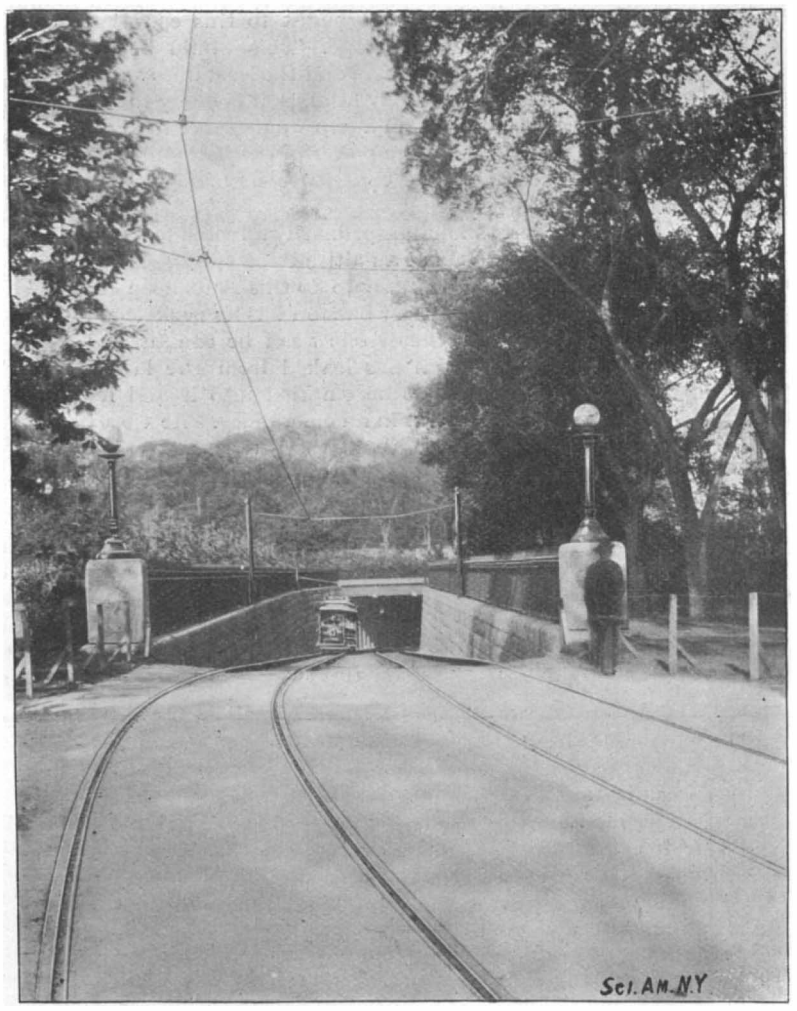
The problem was not one of providing rapid transit for a long distance, but of facilitating traffic upon certain existing and stated routes within a very small area, about one mile long and one-quarter of a mile wide. After a lengthy discussion of the matter, the Boston Transit Commission decided upon a subway system under certain streets by means of which the electric cars would be diverted from the surface of the streets on some of the heaviest lines of travel, and would be run underground in a well drained, ventilated and lighted tunnel, which would, of course, be free from the objections to underground railways in which steam locomotives are used. Three of the twelve sections are now entirely completed and cars are running through them, giving great relief to the overcrowded streets above.

The subway act was passed in July, 1894, by the Legislature of the Commonwealth of Massachusetts. There was a persistent fight made against it by an element of the community which was hostile to the construction of a subway. The friends of the subway were also obliged to contend with those who were hostile to it from a purely business point of view and also against a public sentiment which wished for no encroachment on the sacred soil of the historic Common. The latter were extremely bitter in their antagonism to the subway plan, but at last the friends of the plan succeeded in stifling the opposition and the Subway Act became a law. The opposition was soon after revived, and an injunction restraining the commission from constructing the subway was refused by the Supreme Court, June 15, 1896. The subway has been constructed under the direction of a commission of five men appointed by the Governor and the Mayor, the Hon. George G. Crocker being the chairman. The completed work will cost something under $7,000,000.

Having now briefly referred to the plan as a whole, we will take up our engravings. Many of the salient features of the subway have been described in the SCIENTIFIC AMERICAN for August 31, 1895, and September 5, 1896, and in the SCIENTIFIC AMERICAN SUPPLEMENT, June 29, 1895, No. 1017.

Sections 1, 2 and 3 consist of a two track subway, commencing at the foot of the incline at the Public Garden, just west of Charles Street, and running under the Boylston Street mall of the Common at the intersection of Boylston and Tremont Streets, where the Boylston Street station is located, as shown in one of our engravings. The four track subway extends northerly from this station under the Tremont Street mall to a point just below Temple Place, where the tracks separate to form the important Park Street station, the two inner tracks forming the north and south bound tracks for the cars running to and from the Back Bay, Brookline, Brighton, etc. At the Park Street station the inner tracks terminate in a loop which accommodates the cars which formerly ran to the old Tremont House and then returned.

Sections 4 and 5, which are nearly completed, are also shown in our engravings. The cars run up to Tremont Street to Warrenton Street, and then emerge from the subway by an incline and run up Tremont Street and Shawmut Avenue respectively. For a short distance this is a four track subway, but the four tracks run into two which pass through to Causeway Street in the northern part of the city.

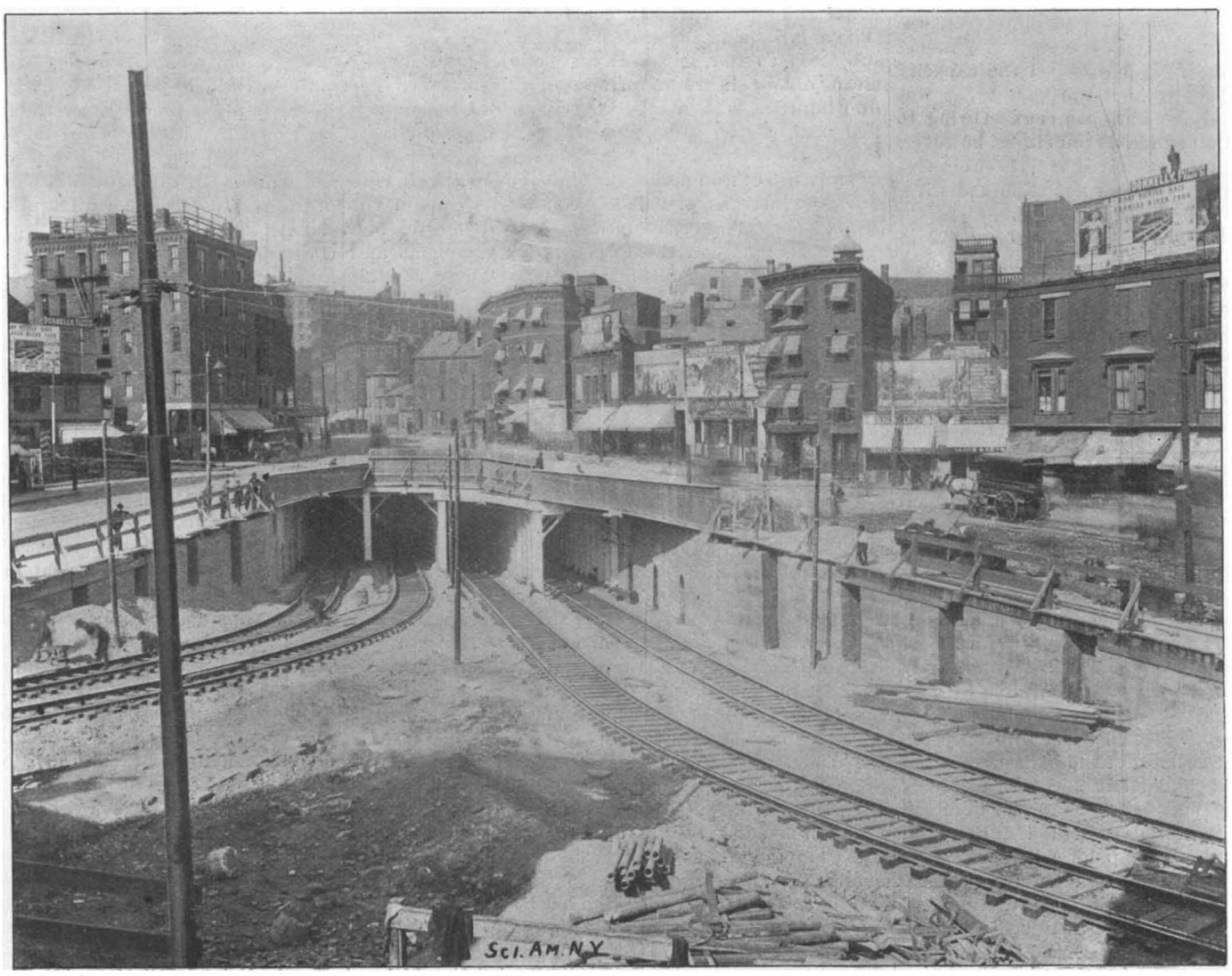


ENTRANCE TO THE SUBWAY IN THE PUBLIC GARDEN.

The cars coming down from Boylston Street turn out of this street at Church Street and enter the subway in the Public Garden by an incline, which is shown in our engraving. The entrance to the incline is intended to be monumental in character and mask it. The first section consists of 318 feet of incline, 685 feet of two track subway and finally 408 feet of four track subway, the latter beginning at the Boylson Street station. The incline was illustrated in the SCIENTIFIC AMERICAN for September 8, 1896, this engraving showing the retaining walls which were constructed upon concrete foundations. In this two track subway, in order to avoid lateral pressure in the tunnel near the surface, the arch type of construction was not used, and the tunnel has been given a flat roof supported by brick arches turned between I beams. The sides are of similar construction, the I beams standing vertically. This establishes a number of arches both horizontal and vertical, each one of 6 feet chord. Diagonal struts connect the vertical and horizontal beams across the upper corners. Some attention was paid to draining this as well as the other parts of the subway, the concrete forming the side walls being plastered with Portland cement and a coating of asphalt applied in turn to it. This asphalt waterproofing was continued over the roof. The pump chamber in the Public Garden contains automatic electric pumps by means of which leakage and rain water are discharged into the street sewer. A masonry ventilating chamber has been constructed near the Boylson Street station and there are others at various points. They are supplied with 7 and 8 feet fans to be driven by electric motors.

The four track subway was made by an open excavation and is 48 feet wide, the two track subway being 24 feet wide. The middle row of steel columns support the roof of the four track subway.

Section 2 really consists of the Bolyston Street station and its approaches. The station proper is 634 feet long, and consists of four tracks and two island platforms, each thirty feet wide. Entrance and exit is given to the Boylston Street station by four ornamental buildings of chiseled granite, which somewhat resemble the stations used in Budapest for the underground railway. One of these is intended for north bound passengers, one for south bound passengers and two for exit. The plan for receiving passengers at the subway stations has been a matter of careful study, the desire of the officials being to reduce to a minimum the possibilities of confusion incident to a heavy rush of passengers. In the place of the surface ticket office, there are set up at the foot of the stairways leading into the tunnel from each of the buildings three booths for the sale of tickets. As the passenger passes into the subway he will stop before one of these offices and obtain a ticket and receive a coupon, which he retains until the conductor of the car takes it up. Between the ticket offices are passages, each of which is wide enough to admit one person at a time. The subway platforms are of smooth artifi-



THE OPEN CUT, SHOWING TRACKS FOR TREMONT AND SHAWMUT AVENUE CARS.

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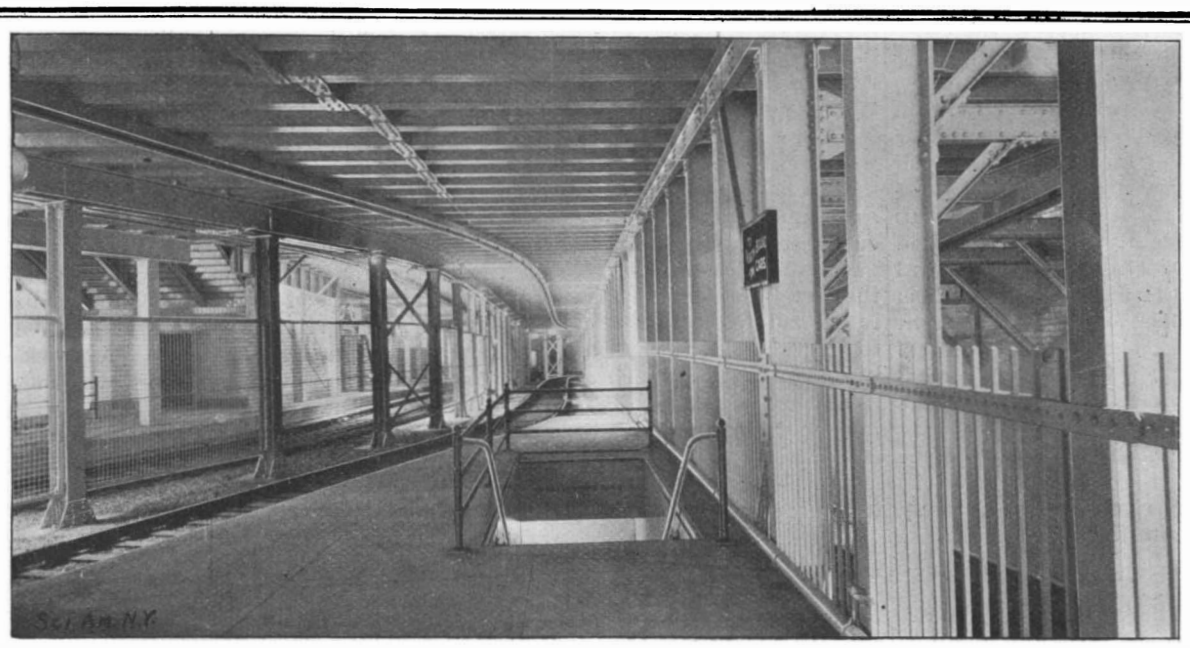
cial stone and between the platforms are high barriers of netting designed to keep people from crossing from one track to the other. The interiors of the stations are as light as day and are covered with enameled brick, which reflects the light of an arc lamp. One of our engravings shows the interior of the Boylston Street station looking south on the track which turns to the right into Boylston Street, passing over the Tremont Street track, which is seen at a lower level through the fence at the right. Our last engraving shows the south bound Tremont Street track passing under the curve to the Boylston Street track just referred to. This crossing of tracks at different levels is a very interesting piece of engineering work, and will tend to avoid accidents and confusion.

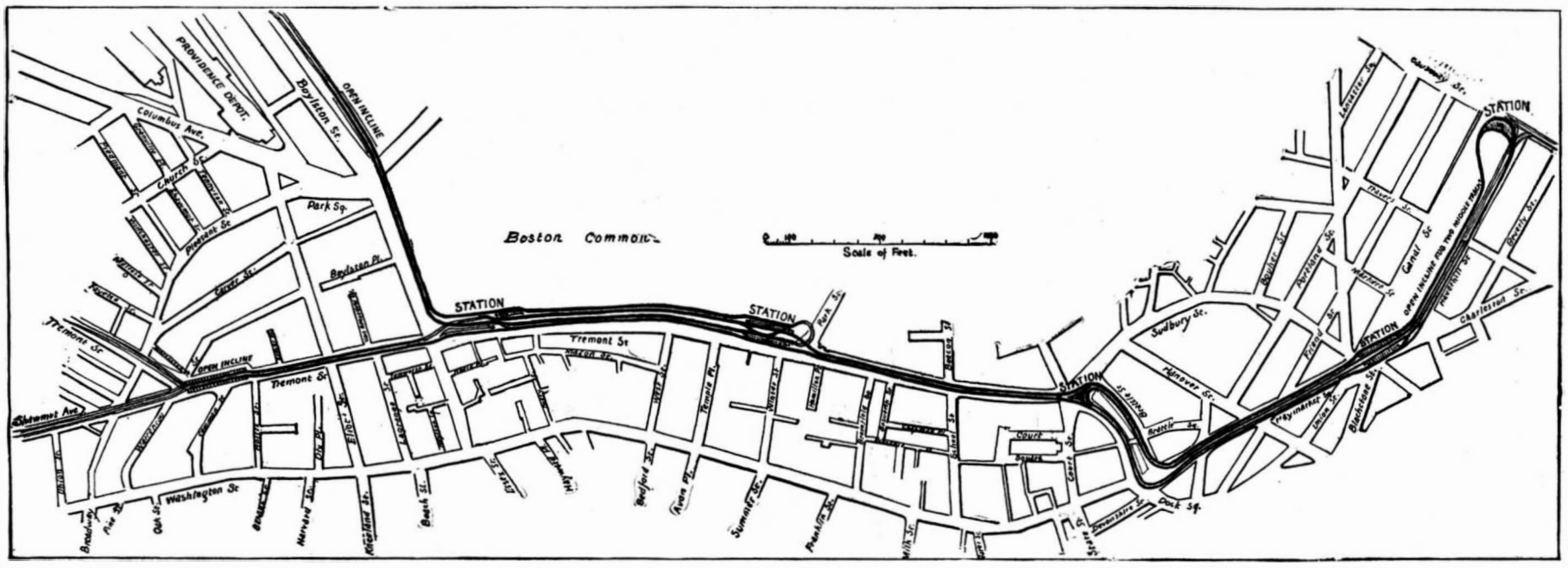


BOYLSTON STREET STATION LOOKING SOUTH, SHOWING THE LOW LEVEL TRACK THROUGH THE FENCE.

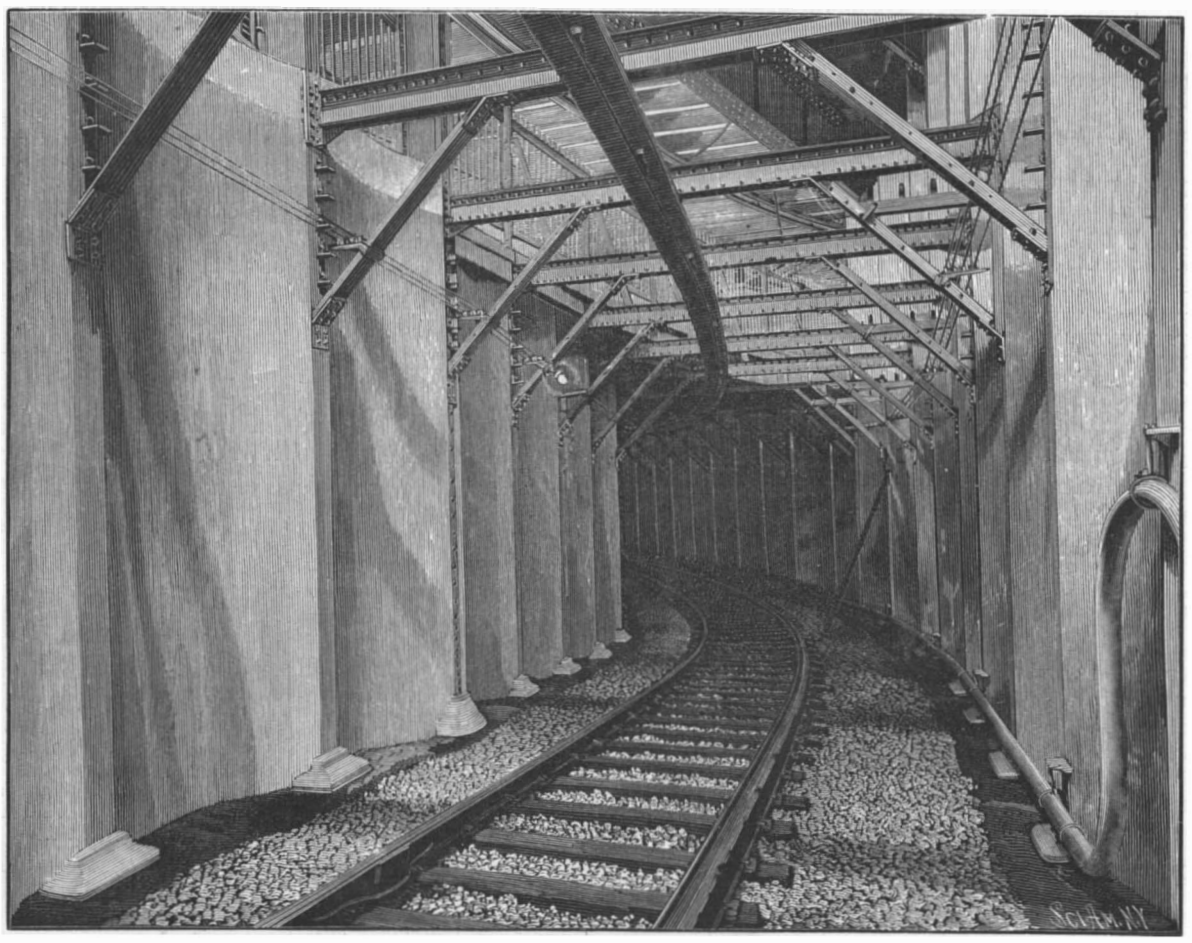
Section 3 consists of a four track subway running from the four track portion of Section 1, which is north of Boylston Street, and the Park Street station itself, which includes the loop. The station consists of two island platforms 250 and 275 feet long, respectively, and the platforms vary in width, the greatest being 40 feet. Each platform is connected with the street by two stairways. Loops are provided so that cars running to Park Street can only be sent on the return journey without the necessity of switching. Tracks are also provided for holding street cars for the rush hours, and also tracks with pits for making temporary repairs. In our engraving of the Park Street station the spectator is supposed to be looking north, and sees where the track commences to turn the loop to return south. At the northern end of the station, the two outside tracks, after passing around the loop, converge into two separate single track subways, which unite and go down Tremont Street toward Scollay Square. This part of the work is not completed as yet.

Sections 4 and 5, which are almost complete, consist of two two track inclines, and the four and two track subways run up Tremont Street to the Boylston Street station. It consists of two two track inclines, a short length of two track subways which finally run into two separate single track subways, one for the south bound cars at a lower level, 39 feet below the street at Boylston Street, while that of the north bound cars is only 22 feet below the surface. These two subways converge into a double barrel subway opposite the new Hotel Touraine, both being brought to the same level before reaching Eliot Street, where the two tracks are carried in a wide single arch subway. At Hollis Street the westerly track is depressed and branches into another double bell mouth. One side is for the south bound Tremont Street cars and the other for the south bound Shawmut Avenue cars, while the east barrel rises until it crosses over the south bound Shawmut Avenue subway to carry the north bound street cars without the necessity of crossing at grade. This represents a most interesting piece of engineering work, and the different grades of the tracks are well shown in our engraving, which shows the south bound track divided where the Shawmut Avenue cars pass under the north bound Tremont Street cars. This section of the subway is not quite completed as yet. Refuge niches will be seen in the side walls.

The track used throughout the subway is the Am. S. C. E. standard, weighing 85 ponnds to the yard, with continuous joints. Each rail is protected by a guard rail, weighing 45 pounds to the yard. The rails are spiked to oak ties. The ties are laid on broken stone, and carefully ballasted with it. Each rail is connected by a copper bond. The ordinary overhead trolley system is used. An inverted wooden trough is fastened to the iron work of the roof, and insulated with sheet rubber. The trolley wire is supported by special bolts and clips which are insulated. The system used does not differ much from that used in Brooklyn, where the wires are suspended from the elevated structure. At present the current is taken from the underground feeder, but direct cables to the power station for supplying current to the subway alone will be added. It will be noticed that the subway is a direct continuation of the surface trolley lines, no change being made in either the motive power or the method of furnishing the current to the cars.



MAP SHOWING ROUTE OF BOSTON SUBWAY.



SOUTH BOUND TREMONT STREET TRACK PASSING UNDER CURVE TO BOYLSTON STREET.

The subway is lighted throughout by both incandescent and arc lamps. In the portion now in operation 600 incandescent and 55 arc lights are used. The arc lights are used for lighting the stations. The system of electric block signals is in process of installation, and electric heaters are located in the ticket offices.

The Chief Engineer is Mr. Howard A. Carson. The Boston Transit Commissioners are: George G. Crocker, chairman; Charles H. Dalton, Thomas J. Gargan, George F. Swain, Horace G. Allen.

WE learn from the Revue Scientifique that it is proposed to found an experimental station in Madagascar, for the introduction of European cereals and the improvement of local vegetable produce.

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Natural History Notes.

Preservation of Fungi.—At the last meeting of the Société Helvétique des Sciences Naturelles, M. Tschirch presented a memoir upon the method employed by him for preserving specimens of fungi with their natural form and color. He begins by placing the specimens in alcohol containing a little sulphuric acid. In this way they are sterilized, the albumen is coagulated and the water is replaced by alcohol. He afterward allows the fungi to dry in the air and then places them in oil of vaseline (liquid paraffine) to which five per cent of phenol has been added. The fungi thus treated, says M. Tschirch, preserve their form and color admirably and do not change. If the colors are delicate and are capable of being extracted by alcohol, the caps must not be exposed to liquid alcohol, but only to the vapors thereof; after which they are put into the phenic vaseline. Red, however, cannot be perfectly preserved even with these precautions; but for all other colors the process, after a long trial, has proved a complete success.

The Speed of the Camel.—The "ship of the desert" enjoys the reputation among many people of going at a rapid gait and of covering great distances in a short time. Chasse et Peche (quoted by the Revue Scientifique) remarks that this is a great mistake. The camel which, according to tradition, carried Mahomet in four bounds from Jerusalem to Mecca, has evidently left no successor worthy of it, since the truth is that the present camels do not make more than about seven miles an hour, and, furthermore, do not keep up this gait for more than two hours at a time. Camel drivers claim that the animals could not do any better than this without danger, since, if they were forced, they might "rupture their hearts" and die at once. The camel, when forced or overdriven, kneels and will not budge under any consideration.

Trees and Lightning.—The immunity of certain trees to lightning stroke has been recognized for a long time, and has often been verified, but the cause of the phenomenon has given rise to various interpretations; and, it may be added, the question is at present still very obscure.

Ciel et Terre gives some information upon this subject borrowed from a memoir by M. Hess published in the Mittheilungen der Thurgauer Naturhistorischen Gesellschaft:

Pechuel-Loesche, taking as a basis some observations made in the vicinity of Jena, in the valley of the Saale, expresses the opinion that when trees send their roots down into very damp earth they are more subject to lightning stroke than their neighbors, even when the latter are taller. Caspary does not look at the matter in this light; but Von Boss upholds the opinion in saying that the fact is explained by the perfect conductivity of the path thus offered to the lightning, and thinks that the trees oftenest struck are those that have long roots. Jonesco remarks that, in reality, this has never been proved, and M. Hess adds that the true cause of such divergences results from the want of documents.

The first important data in regard to the question were given by Hellmann, in 1886, in his Beiträge zur Statistik der Blitzschläge in Deutschland. These confirm the common opinion that lightning strikes oaks especially, but seldom strikes beeches. In 1893 Dimitri Jonesco took up the question again from an experimental standpoint. Interposing between the two poles of a Holtz machine pieces of different kinds of wood of the same section and length, he determined the quantities of electricity that the condensers had to be charged with in order to obtain a discharge. The following are the average corresponding quantities in electrostatic units. The fragments had been cut in January and February:

Linden (Tilia parvifolia)	55
Scotch fir (Pinus sylvestris)	50
White birch (Betula alba)	45
Silver fir (Picea vulgaris)	50
Beech (Fagus sylvatica)	17·5
Oak (Quercus pedunculata)	12·5

Along with these researches Jonesco took up a microscopic study of the woods utilized, and found that the quantity of oily or resinous matter that they contained followed the same increasing proportion as their resistance to the discharges. These researches accord well with the numerical data given by Hellmann. He therefore thinks that this is the true cause of the very marked difference that is observed between the proportions of the different species struck by lightning. The conductivity diminishes in measure as the proportion of oils increases. Jonesco absolutely rejects the opinion of Hellmann that the nature of the earth plays an important part in the phenomenon.

The poplar is not mentioned above, but it results from Jonesco's experiments that this tree is one of the best conductors of electricity. It has had that reputation for a long time. M. Colladon states that poplars planted near dwellings may, under favorable circumstances, form excellent lightning protectors, owing to their height and their conductivity for the electric fluid.

The Nest-building Instinct.—There is a goodly number of instincts, says the Revue Scientifique, upon the subject of which we know but very little, and, when it becomes a question of explaining certain forms of activity of animals, naturalists and psychologists remain equally perplexed. Does the bird build its nest instinctively or through imitation? The theory of imitation has often been defended, and it has been said that although many birds in the first reproductive season lose some time in grouping the elements of their nests without succeeding in constructing anything worthy of the name, this is due to the fact that the remembrance of the nest in which they first saw daylight is still confused and uncertain. This explanation seems very whimsical, since it is difficult to believe that the young bird in its nest pays such attention to the structure of the latter, and, through the lining, perceives the arrangement of the materials, and remembers the characteristic method of manufacture. The construction of the nest must be attributed rather to a hereditary instinct, although the difficulties in the way of this view are also considerable. Mr. A. G. Butler, who discusses this question in a recent number of the Zoologist, has several times observed the fact that canary birds (the progenitors of which were subjected to the artificial life of the cage three hundred years ago), when set at relative liberty in an aviary, construct therein nests that are very similar to those built by their species in a wild state. It is unnecessary to say that this could not be a question of imitation, but one of hereditary instinct.

The Reproduction of the Truffle.—The manner in which the truffle is reproduced has been a puzzle to botanists, who have generally confined themselves to theories in regard to the question. A recent communication to the Academie des Sciences by M. Grimblot throws an interesting light upon the subject. It would seem that the diffusion of the spores is effected by wood mice. M. Grimblot's researches are in a line with the experiments that are now being made by several land owners of Lot and Correze to ascertain whether the diffusion of the spores is not effected through the intermedium of cattle, and particularly of certain domestic animals of quick digestion. It is also thought that the moist heat to which the spores are submitted in the intestines of these animals is one of the factors necessary for the development of the spores of this valuable edible fungus.

The opinion has long been held that the spores of the common mushroom will not develop unless they have passed through the intestines of a horse or cow.

The American Lawyer Crop.

Mr. Percy L. Edwards, in the Michigan Law Journal, avers that the advent of the law school "has furnished ample relief to the once aching necessity in this country for more lawyers!" We should say so, responds the Legal Adviser. There are now in this "model republic" not less than 90,000 professional lawyers, or one lawyer to every 800 of the population. In the greater cities, the ratio of lawyers to other folk is still greater. In Chicago, for example, a recently compiled directory of lawyers shows that nearly five thousand lawyers are struggling for existence, or one lawyer to every 350 inhabitants. In half a dozen other American cities the ratio of lawyers to laymen is about the same. In other civilized countries the proportion of lawyers to possible clients is much smaller. France, with a population of forty millions, has only 6,000 lawyers—1,000 more than Chicago—a ratio of 1 to less than 5,000. Germany, with more than 45,000,000 population, has but 7,000 lawyers—1 to about 6,500. In Great Britain the proportion of lawyers to other folk is about the same.

Statistics show an amazing increase of annual "crop" of American lawyers in the last fourth of a century. In 1870, the law schools reported 1,611 students; in 1885, 3,054 students; in 1891, 6,106 students; in 1894, over 7,600 students. Last year the reported number of law schools had swollen to 85, and of law students to more than 10,000. This rapid increase of the supply of lawyers certainly has not been the consequence of an increasing demand. Instead of increasing in the ratio of the increase of lawyers, the business and emoluments of the legal profession have diminished. Mr. Edwards deems it "safe to say that, approximately, fifty per cent of the ordinary revenues of the old time law office have been cut off in recent years. Since banking institutions have engaged in the semi-professional occupation of collecting claims and rents, and loaning money, and taking securities, and since the business of conveyancing, which at one time was inseparable from a law office, is now no longer the necessary adjunct which it was, lawyers have found their income very greatly reduced." Moreover, the functions of the lawyer, obeying the inevitable law of evolution, have steadily tended to specialization and concentration. In Chicago and its environs, for example, the bulk of legal business is transacted by hardly more than one hundred law offices, leaving more than four thousand lawyers to skirmish and forage for a precarious existence as they can. It is the same in other populous centers.

One of the fields into which this skirmishing for existence is carried by briefless lawyers is the production of more lawyers. The grand army of the legal skirmishers is annually increased by increase of the number of law schools—establishments not founded to make lawyers so much as to extract from deluded young men who bamboozle themselves with the ambition to become lawyers the means of subsistence for superfluous lawyers already made, or half made. The principle on which a prodigious number of these prolific law schools are based seems to be much the same as that of our political system, namely, that the less a man knows of the science and art of administration, the better is he qualified for the administrative service of government. The consequence is a steadily increasing annual deluge of underdone lawyers cast upon the barren shore of a congested profession to struggle for existence in "ways that are dark and tricks that" are the reverse of elevating to American manhood.

The Use of the Hair.

An article by Dr. Exner in the Vienna Klinische Wochenschrift is abstracted in the Boston Medical and Surgical Journal. He states his belief that the bodies of our ancestors were totally covered with hair, and that its present disappearance is due to the fact that its absence was regarded as a beauty, and hence that, in the choice of mates, preference was always given to those that had the least of it. "As to the physiological functions of hairs," says Dr. Exner, "it is admitted that they are modified sense organs, which have lost all connection with the nerves. It is probable that in primitive man the distribution of the hair upon the body was irregular, and that the length, color, structure and thickness of the hair varied with functions for which it was intended. The hair which has been left upon the body in the process of evolution has been left there for a definite purpose. Certain hairs serve as organs of touch, notably the eyelashes, the bulbs of which are surrounded by a network of nerve fibers, and in a less degree the hairs of the eyebrows. Both these serve to protect the eyes; for, being sensitive, they give warning of danger, so that reflex closure of the lids is produced. The eyebrows also prevent drops of sweat from running into the eyes, while the eyelashes keep out dust. . . . In animals the hair serves to maintain and regulate the heat of the body, but in man the hair of the scalp alone serves this purpose. Hair is itself a poor conductor of heat, and retains air, also a poor conductor, in its interstices. The fact that the forehead is not covered with hair Exner explains on the theory that in the contest between the natural tendency of the hair to protect the head against changes of temperature and the tendency of human nature toward beauty, the latter has prevailed more easily, because the non-conducting properties of that portion of the skull are increased by the air-containing frontal sinuses, and that that portion of the head is easily protected from the heat of the sun by inclining the head forward."

Antiquity of Writing.

It is observed by Dr. Bühler, in his book on Indian palæography, that a very remote period is indicated for the beginning of writing by the fact that in a Jain text of about 300 B. C. its origin is forgotten and its invention attributed to the creator Brahma. Indian imitations of Greek drachmas prove that the Greek alphabet was employed in northwestern India before the time of Alexander the Great. Knowledge of the art of writing is established for the earliest Vedic period by one of the great works; and the grammarian Panini, who is assigned to the fourth century, mentions Greek writing and the words signifying writer. The evidence of the canonical books of Ceylon indicates that the knowledge of writing was pre-Buddhistic; and passages in the Jataka and in the Maha Vagga prove the existence, at the time of their composition, of writing schools and of a wooden slate, such as is still used in Indian elementary schools. Writing, as a subject of elementary instruction, is also mentioned in an inscription of the second century before Christ. The palæographical evidence of the Asoka inscription clearly shows that writing was no recent invention in the third century before Christ; for most of the letters have several, often very divergent, forms, sometimes nine or ten.

The Cramps' Annual Report.

The William Cramp Ship and Engine Building Company, of Philadelphia, makes this report for the fiscal year ended April 30:

Gross earnings		$4,500,000
Profit		770,000
General expenses, including interest, taxes, insurance, etc.		340,000
Profit for year		$430,000
Capital stock	$4,848,000	
Bonds and mortgages	300,000	
Debt paid off during year		995,000
Balance unpaid of Drexel & Co. notes		750,000
Due from United States and others		1,675,000
All current debts due		1,350,000
Excess of cash and cash items		$325.000
Total assets of company		7,800,000
Total liabilities		6.675,000
Credit and profit and loss		$1,125,000
Material on hand		250,000

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"METEMPSYCHOSIS." *

"Metempsychosis" is the name of an illusion which was the joint invention of Messrs. Walker and Pepper, of London. It was devised by the former gentleman, and the latter assisted in perfecting it. It is probably the most mystifying of any of the optical tricks. It has of late years been shown in America, by Kellar, under the title of the "Blue Room." The first effect produced upon the spectator after witnessing the illusion is that he has been dreaming, or seeing ghosts or spirits, for it seems utterly impossible for man to accomplish the wonders produced by it.

Our first engraving shows the stage set as an artist's studio. Through the center of the rear drop scene is

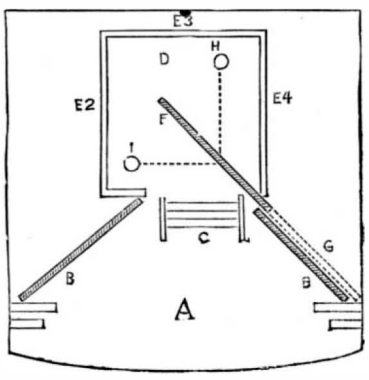

Fig. 2.

seen a small chamber in which is a suit of armor standing upright. The floor of this apartment is raised above the level of the stage and is approached by a short flight of steps. When the curtain is raised a servant makes his appearance and begins to dust and clean the apartments. He finally comes to the suit of armor, taking it apart, cleans and dusts it, and finally reassembles it. No sooner is the suit of armor perfectly articulated than the soulless mailed figure deals the servant a blow. The domestic, with a cry of fear, drops his duster, flies down the steps into the large room, the suit of armor pursuing him, wrestling with him, and kicking him all over the stage. When the suit of armor considers that it has punished the servant sufficiently, it returns to its original position in the small chamber just as the master of the house enters, brought there by the noise and cries of the servant, from whom he demands an explanation of the commotion. Upon being told, he derides the servant's fear, and, to prove that he was mistaken, takes the suit of armor apart, throwing it piece by piece upon the floor. This is only one of the countless effects which can be produced by this interesting illusion.

The working of the illusion will be understood by reference to the diagram, Fig. 2. At A we have the proscenium opening; B B are two flats of scenery which close in the scene from the front wings to the steps, C, which in their turn lead up to the small chamber, D, at the back, in which all the changes occur. The walls of the chamber are lettered E^1, E^2, E^3, E^4. F is a large mirror extending from floor to ceiling, and capable of being wheeled back and forth on a truck or carriage. When this mirror is withdrawn, as seen at the dotted lines, G, the spectators see through the opening of the chamber to the rear wall. The suit of armor is marked H. Now, if the mirror be pushed across the chamber, both the armor, H, and the rear wall disappear, and the walls of the chamber at E^1 and E^2 are reflected so that they appear to be the walls E^3 and E^4. There is another suit of armor at I. It is placed so that, when it is reflected in the mirror, it will occupy the exact position of the other suit of armor, H. When the mirror is shoved forward and hides the suit of armor, H, an actor dressed in a similar suit enters behind the glass by a secret door, removes the dummy armor, and assumes the same place himself. All this time the suit of armor at I is reflected in the mirror, so that a suit of armor is always visible. The mirror is now drawn back, and the suit of armor which the actor wears is seen. When the servant now dusts the armor, it suddenly seems to become endowed with life and chases him around the room; and when it again mounts the steps in the smaller room, the mirror is shoved forward, the actor making his escape in time to place the first suit of armor where it formerly stood. Now the mirror is again drawn out, revealing the sides of the room, E^3 and E^4, and, of course, exposing the suit of armor, H. If the walls, E^1 and E^2, and the armor, I, are correctly placed as regards reflection, he can pass the mirror to and fro at will, without any change being detected, as the reflection takes the place of the reality, and we suppose we are looking at the real object.

As the edge of the mirror passes the suit of armor a hard line is to be seen, a distinct vertical line, which would seem to wipe out the object as it passes. To avoid this, the inventors hit upon a novel and purely ingenious expedient. They etched vertical lines in the silver back of the glass at the end which first passes across the field of view, beginning with thick silvered spaces close together, and tapering, with the lines farther apart as shown in our diagram, Fig. 3. It can thus be seen that the reflected article gradually appears instead of coming suddenly into view, and when the mirror is moved away the real article gradually appears.

In order that the edges of the glass may be better disguised as it moves forward or backward, the edge is cut or ground into steps, as shown in Fig. 4.

By the apparatus described above, many changes can be made, as a living man appearing in a previously empty chair, flowers growing on an empty bush, a change of a man into a woman, a painted picture into a living one, etc. In some effects a table is employed, to all appearances the common square kitchen table. A person is seen sitting at the table, which is empty; suddenly there appears before him a large dish of oranges or a meal. This is arranged by providing the table with a slot which runs diagonally from corner to corner. This allows the glass to travel through it, and thus shuts off one-half of the table. Articles are placed on the table, behind the glass, which is now withdrawn, leaving them to be seen upon the table. The slot in the top of the table is covered with sheet rubber or other material.

Fig. 1.—"METEMPSYCHOSIS."

* Copyrighted, 1897, by Munn & Company. From "Magic: Stage Illusions and Scientific Diversions, including Trick Photography." Just published.

Simple Test for Noxious Gases in the Air of Mines.

For detecting deleterious reducing gases such as carbonic oxide, methane, etc., in the air of mines, A. Mermet finds a dilute solution of potassium permanganate, containing a little nitric acid, highly efficient, the effect of these gases being to decolorize the permanganate solution. The reaction goes on more rapidly when the solution also contains silver nitrate, one part of carbonic oxide per 500 to 5,000 parts of air decolorizing the liquid in from one to twenty-four hours. The reagent is prepared as follows: Silver nitrate solution: Two or three grammes of silver nitrate crystals dissolved in 1 liter of water. Potassium permanganate solution: 1 liter of distilled water boiled with a few drops of pure nitric acid (free from hydrochloric acid), a little permanganate solution being added until the liquid becomes rose colored, in order to destroy any organic matter which may have found its way into the water, as dust, etc. When cold 1 gramme of potassium permanganate crystals is dissolved in the water and 50 cubic centimeters of nitric acid added to it. For use 20 cubic centimeters of the silver nitrate solution, 1 cubic centimeter of the permanganate solution, and 1 cubic centimeter of pure nitric acid are mixed and made up to 50 cubic centimeters with distilled water freed from organic matter. The reagent must be used immediately. To collect a sample of air from the gallery of a mine, a flask is filled with pure distilled water and emptied in the gallery, the air entering the flask by displacement. When the air is dusty the flask should be fitted with a paraffined cork with two tubes, one for the outflow of the water and the other filled with cotton wool to filter the ingoing air. The bottle must then be closed by a glass stopper, since the organic matter in cork would decolorize the reagent and spoil the test. A second flask being filled with normal air,

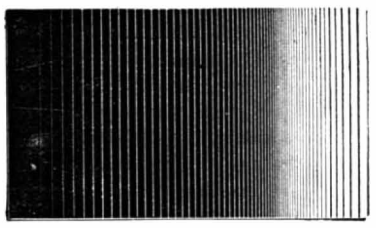

Fig. 3.

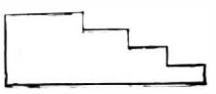

Fig. 4.

some of the reagent is poured into both and they are then placed side by side on a sheet of white paper. After some time the impure air will decolorize the liquid, whereas that in the flask of normal air will retain its original rose color. This decoloration is more rapidly effected in proportion as the quantity of reducing gases is greater. The actual nature of the impurity can then be ascertained by ordinary methods, but sulphur, if present, reveals itself during the initial reaction by combining with the silver salt to form sulphide, which turns the reagent brown.—Colliery Guardian.

Dust and the Clearness of the Air.

The effect of atmospheric dust in altering the visibility of distant mountains is discussed by Herr Schultheiss in a recent number of the Meteorologische Zeitschrift. Science (April 16) condenses his results as follows: Observations on the visibility of the Alps have been made for twenty years past at Höchenschwand, a station in the southern Black Forest, at an altitude of 1,000 meters (3,280 feet) and commanding, under favorable conditions, an extended view of the Alps as far as Mont Blanc. Three degrees of visibility are noted, designated respectively as 0, 1, and 2, the latter figure denoting the greatest clearness of view. A careful study of the records and of the weather conditions prevailing at the times of observation reveals the fact that the visibility is best under anticyclonic conditions (the presence of an area of high barometer). . . . There is a descending movement of the atmosphere, and as the upper strata are cleaner and purer than the lower, this process results in causing greater clearness of the air and hence a higher degree of visibility. Ninety per cent of all the cases in which the view of the distant Alps was clear are found to be associated with such . . . conditions. Cleaning the air by means of rain seems to be the controlling factor in the majority of the other 10 per cent of cases. Naturally, as anticyclones are more frequent and longer lived over central Europe in winter, the visibility is greater in winter and less in summer. There is a common belief, here as well as in Europe, that very clear days, which give very good views of distant mountains, are most likely to be followed by rain. Schultheiss has investigated this question in the case of the Alps as seen from Höchenschwand, and finds that a very clear view is seldom closely followed by rain. He also finds that the dust in the atmosphere at 1,000 meters is very fine and does not include large quantities of coarser smoke particles, as it does at lower levels.

THE Chilean government telegraph lines now comprise about 7,500 miles.

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Bathing: Its Relation to Diseases of the Respiratory Tract.

Chronic catarrhal disease of the nose, throat, bronchi or lung is rarely, if ever, the outcome of one attack of acute inflammation, properly cured. No; we get a history in these cases of repeated inflammation, with careless or neglected treatment, each a little more severe than its predecessor and none quite cured before its successor had appeared, gradual extension of the trouble, pathological changes, lesions forming, until finally the disease is chronic, inveterate, and a long course of treatment, operations and a change of climate are necessary to restore the mucous membrane to as nearly as possible its former normal standard. I believe that in the majority of these cases the renewed colds, the exacerbations which render catarrhal diseases so prevalent and so intractable, are due, not so much to the variations in climate as to the imprudences people commit, knowing these changes are liable. The three most prolific favoring causes of respiratory disease are injudicious clothing, superheated homes and hot bathing, local or general. The last (being my text) I am emphatic about, because I find in people who look forward to winter with dread as a season of misery—a succession of colds, sore throats, or coughs from fall to spring—when I abolish the hot bath and substitute the cold, that they promptly become less susceptible; colds become less frequent or cease altogether and my treatment for any existing chronic trouble shows an efficacy in marked contrast to what it had been accomplishing.

In speaking of cold bathing I do not necessarily mean the full cold bath, for it takes a person of strong reactive powers to take a cold morning plunge in winter with benefit, although robust people and some not so hearty seem to thrive upon their use. I do not think, however, that they are generally to be recommended.

My special reference is to the bathing of the face, neck, and chest, night and morning, with cold water. The addition of a handful of salt to the bowl of water greatly enhances the effect and should not be omitted. A washcloth of Turkish toweling should be used, as a sponge gives no friction. The water should be hydrant cold. The face, neck and chest should be briskly but thoroughly bathed and then dried by active friction with a Turkish towel and the bather dress rapidly or retire, as the case may be.

The very activity of the proceeding is in itself healthy exercise, which would doubtless not be taken were it not for this incentive. The circulation is stimulated, deep respiration is induced, the arm, back and chest muscles are developed, the skin is left tingling with a healthy glow, but not the warm, soft, perspiring, susceptible redness of the hot bath.

We are creatures of custom. The stoker can stand the terrific heat of the engine room because he is used to it. The policeman grows hale and hearty pacing the cold streets, because he is so constantly exposed. So it is in this matter of cold bathing. The face, neck and chest become accustomed to cold and dampness by a safe method—the daily cold, salt bath. The skin is thereby stimulated and hardened by a system, so to speak, of daily exposure, so that the sudden contact with lowered temperature, draught or storm does not shock it; hence no chill, and "colds" are avoided.

The surface soon becomes inured to cold and the perambulating shiverer, the man who invariably sneezed when he stepped from the street car, to whom the frequent nip of whisky seemed a preventive necessity; the man who went cringing along the streets in winter with his head so buried in his overcoat that his best friends could not recognize him out of doors, now discards his muffler, turns down his coat collar, holds his head erect and exposes his face and neck to the blast, buoyed up by the crisp air, instead of shrinking from it as before—now fairly reveling in the nipping breezes that play against his throat and sting his nostrils.

He ceases to be the perennial prey of the laryngologist and the wilds of New Mexico shall know him not.—H. Worthington Paige, New York, in the Southern California Practitioner.

The Psychogenesis of Fear.

Fear is a psychical condition which has received comparatively scant attention at the hands of psychologists, common as are its manifestations and obscure as is its mechanism, says the Medical Press. Transcendental philosophers regard fear as the automatic stimulus for a reflex co-ordination of movements intended to protect the organism against impending injury, but the moment we begin seriously to scrutinize the outward and visible effects of this condition it becomes painfully apparent that, far from aiding escape from danger, it is often per se the direct and immediate cause of disaster. Angelo Mosso, in his very fascinating treatise on this subject, reiterates Haller's view, that the phenomena of fear common to all animals are not conducive to the preservation of the timid, but rather to their destruction, it being part of the law of nature, as understood by him, that animals destined to be the prey of others should not be able to defend themselves easily.

Without committing ourselves to this somewhat brutal hypothesis, it is a matter of common observation that fear renders the individual more vulnerable to attack, and, for the time being, subordinates the will to the influence of conflicting and often incomprehensible emotions. It is suggested that the kneeling attitude universally adopted in prayer is to be ascribed to the physiologic fact that strong emotions cause a sudden trembling of the legs and oblige us to sink to the ground. Darwin, in his "Expression of the Emotions," attributed a preponderating importance to the will as the cause of expression; but, as the author remarks, what many call free will is only a fatal necessity, an indissoluble chain of causes and effects, of physical and mechanical actions; of automatic and unconscious reactions, in the living machine. Hence, in studying the expressions of fear we must look to the reflex nervous apparatus, which alone can explain the explosive suddenness of the phenomena of acute fear. Physiologists recognize that stimuli accumulate in the spinal cord, when becomes slowly charged like a Leyden jar, until suddenly discharged by a contact or by some very slight impression. When we have something in the throat which tickles us, the slight and at first scarcely perceptible irritation by and by becomes intolerable, and in the functions of reproduction the repetition of slight stimuli produces greater and more and more uncontrollable reflex movements.

Such an explosion seems out of all proportion to the momentary and trivial cause, but this is because we overlook the fact that the force has been accumulating until, to borrow an expression from physics, its tension is greater than the pressure of the will. It is, he observes, the quantity, not the quality, of the stimulus which determines the intensity of the expressions. Prof. Mosso suggests that nature has been unable to find a substance for brain and spinal cord which should be extremely sensitive and yet should never, under the influence of strong stimuli, exceed in its reaction those physiologic limits which are best adapted to the preservation of the animal. Be this as it may, fear may be described as a chaotic explosion of emotions due to an irregular, and therefore imperfect, supply of blood to the brain. Every action is preceded, every thought is accompanied, by vasomotor dilatation of the vessels in the brain, the distribution of the area of vascularization being determined either by the controlling area of consciousness or by the repercussive influence of some external stimulus.

RECENTLY PATENTED INVENTIONS.

Railway Appliances.

AIR BRAKE ALARM COCK.—Adam McIntosh, Albany, N. Y. This improvement comprises a three-way cock in the signal pipe and an auxiliary cock opening and closing in unison with the opening and closing of the signal pipe cock, the auxiliary cock being connected with the alarm and with the signal pipe. The device is of simple construction, and the arrangement is such that the train pipe nozzle cock and the cock for the signal pipe cannot be closed without giving an alarm to the engineer and the conductor of the train.

RAILWAY GAGE BAR.—Peter Olson, Field, Canada. An adjustable tie rod is provided by this invention for connecting the rails of a track, the length of the rod being adjustable to accommodate it to the different gages used on curves. It comprises two bars having hooks adapted to engage the outer edge of the rail base, means for drawing the bars inward, while other bars slide upon the first ones and engage with the inner edges of the rail base. With this device the tendency of the rails to spread on curves may be quickly and easily corrected, and without drawing the spikes from the ties, the rails being drawn together by driving a wedge.

RAILWAY SIGNALING. — Georges De Bengy Puyvallee and Joseph Ambroise Meunier, Paris, France. An arrangement for notifying and recording way signals on locomotives has been devised by these inventors, which comprises the placing of the signals along the line and on the locomotives into mechanical relations with each other, to warn the drivers when the line is blocked, and at the same time keeping a record of such notifications. The invention also enables trains to place the line signals into a position giving notice that the line is blocked, to protect their passage from the rear, and to release the signals after passing a sufficient distance.

Bicycles, Etc.

BICYCLE CHANGE GEAR.—Bernt T. Nedland and Christian Fredrickson, Westby, Wis. This is a device applicable to any form of bicycles, a beveled gear having concentric rings of beveled teeth being attached to the crank axle, while a shaft with beveled pinions may be connected or disconnected therewith by means of a pivoted lever having segment arms composed of concentric and eccentric surfaces. The shifting device is controlled by a single lever, and it is impossible to have more than one of the pinions in engagement with the gear wheel at the same time, the change being quickly made from one speed to another.

BICYCLE HANDLE BAR AND TOOL HANDLE.—Karle H. Granger, South Weymouth, Mass. A flexible or yielding hand grip is afforded by this invention, whereby the vibratory movement of the handle bar or handle will not affect the hands, the grip surface consisting of a series of inflatable members preferably placed in spiral arrangement. The handle section is wrapped around by tubing at whose inner end is a valve, by which the tube may be inflated with air, water, or any material which will render the coils elastic. The improvement is also applicable to bicycle pedals, foot cushions, and for many other uses.

Mechanical.

CRUSHING AND GRINDING MILL. — William H. Coward, Erith, England. This mill has a grinding or rubbing action as well as a crushing action, the roller and drum being caused to revolve at different surface speeds, means being provided to enable their relative surface speeds and the distance between their acting surfaces to be varied to suit the material operated on. Improved means are also provided for conveying the material to and repeatedly passing it beneath the crushing roll, to increase the area of the gage plate when the crushed ore is to be concentrated, and to insure the return to the drum of the grosser particles which may be carried off with the blast when the gage plate is not used.

SAW SET.—Henry Neidhardt, Brooklyn, N. Y. This device comprises a standard which supports an anvil, a pressure lever being pivoted in the standard and a setting dog which is operated by the pressure lever. A holding lever is also pivoted in the standard and a lever engaging with the holding lever, there being a yielding connection between the latter lever and the pressure lever. The device may be operated with comparatively little power or pressure to quickly and accurately set the teeth of a saw.

TOOL HOLDER.—John M. Richardson, Daingerfield, Texas. This is a device in which any form of tool, especially hatchets, garden tools, etc., may be quickly and conveniently placed and firmly held against turning or moving in any direction. The holder has a slotted socket in which a shank is arranged to enter, the shank having lugs for engagement with the walls of the slot in the socket, a key being shaped to fit the slot. A clip, which may be integral with the key, prevents the latter from leaving the socket..

Agricultural.

PLOW.—Richard H. Purnell, Rosedale, Miss. To facilitate setting the plow blade at different angles by tilting it on its connection with the standard, the plow is made, according to this invention, with a short depending rear bar adapted for adjustable connection with a foot or sole piece, pivoted at its front end to the lower end of the standard, the rear end of the sole piece having an upturned portion. The sole piece extends for a considerable distance on a straight line back from the blade, and the latter may be of the sweep form or mouldboard form, or in the form of a share, shovel, sweep or scraper.

Miscellaneous.

PIANO ACTION. — Julius H. Block, Moscow, Russia. This action has a gravity damper and a gravity arm normally holding the damper on the strings, the hammer on its forward stroke releasing the damper and permitting it to move by its own weight out of engagement with the strings. No springs of any kind are necessary, the entire arrangement being so balanced that the slightest touch of the key will actuate the hammer and damper, so that great lightness of touch is readily acquired by the performer. The improvement is adapted for use with both square and upright pianos, and is designed to greatly increase the power and volume of tone of the instrument.

SASH HOLDER. — Theodore Martin, Wallaceburg, Canada. This device can be readily attached to a window frame to securely hold either the upper or lower sash as desired, and to form a lock to prevent the sash being opened. It consists of a cramping cam lever with projecting lug, surrounded by a rubber ring on its binding end, while a retaining plate lies parallel to the lever on the outside of the rubber ring. The retaining plate has at its rear edge a laterally projecting lug extending inwardly toward the lever and in rear of and crimping and pinching the rubber ring on its rear side, whereby it is more firmly held and prevented from slipping in its seat.

SCUTTLE COVER.—William L. Springer, Chicago, Ill. A cover hinged on the skylight casing, according to this invention, has stays for connecting it with the casing, each stay being formed with two links pivotally connected with each other and with the cover and the casing, the links being arranged to fold when the cover is closed and to hold the cover in a nearly vertical position when the links are extended. The device is strong and simple, and permits the ready opening of the cover to its full extent to form a convenient passage from within to the roof of a building.

BEDSTEAD.—Augustus E. Strang, Salem, Oregon. An iron bedstead with tubular side rails and angle iron end rails, according to this invention, is made very durable when the parts are assembled, while it may be readily taken down for transportation. The side and end rails are joined to the posts by novel clamping devices which make the bedstead when set up a very rigid and strong structure.

Designs.

SUSPENDER END. — William Bloomberg, New York City. The clip forming part of this suspender end is supported by two united straps or tapes connected with the body portion of the loop.

SKIRT HOLDER.—Robert M. Steindler, New York City. This design provides an elastic bicycle skirt holder of neat appearance and ready application.

GAME BOARD.—Roswell A. Dandaraw and George E. Gordon, Rensselaer, N. Y. This board is made with a central raised barrier resembling a bar, and a series of shorter barriers crossing the main barrier, forming a group of pockets open upon one side.

PARCEL CARRIER.—John P. Smith, New Haven, Conn. This is a device designed for use in connection with bicycles, and consists of a central loop and return lateral arms terminating in hooks.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co. for 10 cents each. Please send name of the patentee, title of invention, and date of this paper.

NEW BOOKS, ETC.

MAXIMUM STRESSES IN FRAMED BRIDGES. By William Cain. New York: D. Van Nostrand Company. 1897. Pp. 23. Price 50 cents.

The matter which forms the basis of the present book appeared originally in the Van Nostrand Magazine of 1878, and was largely concerned with the comparison of weights of bridges and their most economical depths. These subjects have now been practically solved by bridge engineers and the result has been the elimination of many types of bridge trusses once popular and the retention of certain leading forms that have proved most economical and otherwise desirable. The present edition of this work confines itself to the discussion of the types most used at present, and the aim has been to aid the student, in presenting the subject in a simple, clear, and at the same time thorough manner. It will doubtless prove of interest to all bridge engineers.

A NEW WORK ON MECHANICAL DRAWING. In 24 parts. By J. G. A. Meyer. Arnold Publishing Company. Price 50 cents.

The fifth and sixth parts of this interesting work on the general principles of machine design are at hand, continuing the illustrated rules and computations for strength and form of general machinery, and with a practical lesson in steam engine design in each number.

THE ENGINEER'S SKETCH BOOK OF MECHANICAL MOVEMENTS. DEVICES, APPLIANCES, CONTRIVANCES AND DETAILS EMPLOYED IN THE DESIGN AND CONSTRUCTION OF MACHINERY FOR EVERY PURPOSE. By Thomas Walter Barber, Engineer. Third edition, considerably enlarged, with 2603 Illustrations, Descriptive Notes and Memoranda. London: E. & F. N. Spon, Limited. New York: Spon & Chamberlain. 1897. Pp. 335. Price $4.

This book cannot but prove of great value to every engineer and inventor. Every successful engineer is a born inventor; indeed, the daily work of an engineer in practice largely consists in scheming and devising from previous experience new and improved processes, methods and details for accomplishing them and for simplifying and cheapening the old forms of machinery and the work they produced. In the work of designing machinery, the draughtsman has to rely mainly on his memory for inspiration, and for lack of an idea has frequently to wade through numerous volumes to find a detail or movement to effect a particular purpose. His labors, as well as

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those of the engineer, would be greatly simplified by the present book, which is indispensable to every draughtsman. It contains 2603 engravings, giving almost every possible mechanical movement or contrivance which is liable to be called for in a drawing.

THE PROCESS YEAR BOOK FOR 1897. Vol. III. Conducted by William Gamble. London: Penrose & Company. New York: G. Gennert. Pp. 127. Price $1.

This is probably the most beautiful of any of the photographic annuals. It is superbly printed on the finest coated paper. There is a full page plate illustrating some of the finest work of the year in photo-engraving and photo-color work. The articles are very practical and cannot fail to be of great use to the process worker. The annual is a superb picture book, and shows that each year process work is obtaining a firmer foothold.

A PRACTICAL TREATISE ON MINERAL OILS AND THEIR BY-PRODUCTS. By Iltyd. I. Redwood. London: E. & F. N. Spon, Limited. New York: Spon & Chamberlain. 1897. Pp. xiv, 336. Price $6.

This is an important work and devoted particularly to the Scottish shale oil industry, and will doubtless prove of value to the oil manufacturers of the United States. The chapters deal with the geology and geographical distribution of oil-bearing shales, the theoretical and practical side of refining, distilling, etc.; ammonia water, the laboratory, etc. There is also a list of patents relating to the Scotch mineral oil industry.

SCIENTIFIC AMERICAN BUILDING EDITION

SEPTEMBER, 1897.—(No. 143.)

TABLE OF CONTENTS.

No. 1. Plate in colors, also another perspective elevation and floor plans of a residence at Bensonhurst, L. I., recently erected for Mr. Walter Jones. A design treated in an attractive style of architecture, with Colonial feeling and classic detail. Architect and builder, Mr. Walter Jones.

No. 2. A Colonial residence at Springfield, Mass., recently completed for Mr. N. N. Fowler, at a cost of $13,000 complete. Two perspective elevations and floor plans. Mr. Guy Kirkham, architect, Springfield, Mass.

No. 3. Residence at Scranton, Pa., recently erected for Mr. Thomas R. Brooks. A unique design. Two perspective elevations and floor plans. Mr. John A. Duckworth, architect, Scranton, Pa.

No. 4. Elm Park Methodist Episcopal church and parsonage at Scranton, Pa. Two perspective elevations and floor plans, also two perspective elevations of the parsonage, with floor plans, Architects, Messrs. George W. Kramer & Co., New York City.

No. 5. English dwelling at Overbrook, Pa., recently erected for Mr. Smucker. An attractive design treated in the English style, half timber and stone. Perspective elevation and floor plans, also interior view. Architect, Mr. William L. Price, Philadelphia, Pa.

No. 6. Cottage at Binghamton, N. Y., recently erected for Mr. G. N. North, at a cost of $3,200. Two perspective elevations and floor plans. A design with many excellent features, good elevations and well arranged plans. Mr. Elfred Bartoo, architect, Binghamton, N. Y.

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No. 8. Modern suburban villa at Chestnut Hill, Mass., erected for Messrs. Merriam, Isbenbeck & Alvord. A design well treated in the modern American style with Colonial detail. Two perspective elevations and floor plans. Architect, Mr. J. H. Morse, Boston, Mass.

No. 9. A residence at Binghamton, N. Y., recently erected for Miss Q. M. French. Perspective elevation and floor plans. A very attractive design with excellent elevations.

No. 10. An actress' home at Chevy Chase, Md., illustrating the residence of Miss Annie Lewis. Two perspective elevations and floor plans. Mr. Louis D. Meline, architect, Chevy Chase, Md.

No. 11. Half page design of the New Rathsapotheke in Bremen.

No. 12. Pulpit of the Cathedral of Sainte Gudule, Brussels.

No. 13. Miscellaneous Contents: New York as a furniture market.—Advantages of fresh air in apartments.—Exterior plaster for dwellings.—Rules for making good mortar.—Premature occupation of new homes; a test for relative humidity of habitable apartments.—Ventilation of apartments.—Does your faucet leak?—A new recording thermometer, illustrated.—Beautiful work in wood finishing.—Slate roofs.—Dec-co-re-o, illustrated.—Berkfeld filter, illustrated.

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Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(7206) S. M. T. asks: Will you kindly give me in Notes and Queries of SCIENTIFIC AMERICAN a recipe for making rubber cement such as is used for repairing bicycle tires? A. Recipes for cements to mend bicycle tires are given in the "Selected Formulæ" columns of our SUPPLEMENT, Nos. 1070 and 1102, price 10 cents each prepaid by mail. SUPPLEMENT, No. 1102, also has information on methods of repairing tires, illustrated.

(7207) D. M. asks: 1. Has the curious behavior of the gyroscope been fully explained? A. Yes; fully and completely by the aid of mathematics. In general, it is due to the fact that the disk is rotating in two directions at the same time, one as it spins rapidly on its axis, the other a falling motion around the point of support upon the pin. The result is that it makes a spiral motion of descent like a winding stairway. 2. Is there such an instrument as the multiscope? If so, by whom, when, and where was it invented, and what is the meaning of the word? A. No such word is given in the Century Dictionary. "Multiplying glass" and "polyscope" are given. All three would imply the same thing—seeing many objects. The name is applied to a glass flat on one side, while the other, at first curved like a lens, has been ground into facets, or flat places. On looking through it at a candle, for example, as many lights appear as there are flat places. It is used as a toy. If the word you suggest were formed, it should be spelled "multascope."

(7208) W. M. B. asks: Kindly inform me through your paper of the best formula for a developer for lantern slides. Also the method used in coloring them. Please mention the best and latest book on the making and coloring of lantern slides. A. Valuable information about making and coloring lantern slides is contained in our SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 423, 577, 594, 657, 699, 961, 1062, 1082, and 1116, price 10 cents each by mail.

(7209) J. W. asks: Does a base ball curve horizontally, i. e., laterally, after leaving the hand of a pitcher, before striking its object? If it does, kindly explain the cause, whether it is the rotary motion of the ball or what. A. The ball curves as described. Information on this subject, illustrated by diagrams, etc., will be found in SCIENTIFIC AMERICAN, No. 5, vol. 55; also SUPPLEMENT, Nos. 402 and 410. Price 10 cents each, by mail.

(7210) C. A. C. asks: How can I make starch for starching shirts in a steam laundry, so they will be stiff? The starch alone will not make them stiff enough. Also, please give me a receipt for making a polish for shirts and collars. A. Information on starching will be found in SUPPLEMENT, No. 577; recipes for glosses (liquid and powdered) are given in the "Selected Formulæ" columns of the SUPPLEMENT, Nos. 1127 and 1129. Price 10 cents each, by mail.

(7211) B. S. D. asks: Can you inform me whether the method of developing photographic plates prepared with erthyrosin differs from the ordinary method or not? A. There is no special developer needed; an ordinary metol hydroquinone potash or soda developer will answer. (See our SUPPLEMENT, Nos. 541, 714 and 1050. Price 10 cents each, by mail.) Keep the tray covered and as free from any light as possible, only examining progress of image at very brief intervals. 2. What is the simplest way to prepare formic aldehyde? A. No simple way. Can be bought from dealers in photo. materials in New York City easier than to make. 3. Of what are ferrotype plates composed, and what is the process of their manufacture? A. Ferrotype plates are made of thin sheet iron, covered with a black, smooth varnish, which is baked or enameled on. They are made in large quantities by manufacturers. The prepared plate is coated with collodion and sensitized in a nitrate of silver bath, just before exposure in the camera, and it is then immediately developed with a solution of sulphate of iron and acetic acid.

TO INVENTORS.

An experience of nearly fifty years, and the preparation of more than one hundred thousand applications for patents at home and abroad, enable us to understand the laws and practice on both continents, and to possess unequaled facilities for procuring patents everywhere. A synopsis of the patent laws of the United States and all foreign countries may be had on application, and persons contemplating the securing of patents, either at home or abroad, are invited to write to this office for prices, which are low, in accordance with the times and our extensive facilities for conducting the business. Address MUNN & CO., office SCIENTIFIC AMERICAN, 361 Broadway, New York.

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SEPTEMBER 7, 1897,

AND EACH BEARING THAT DATE.

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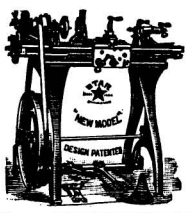

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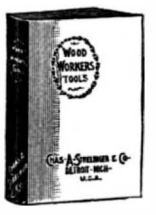

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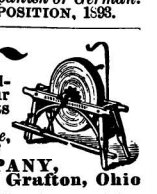

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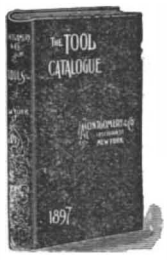

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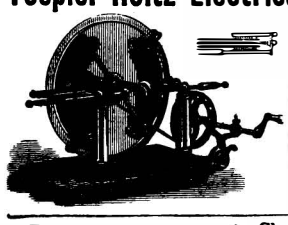

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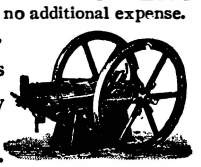

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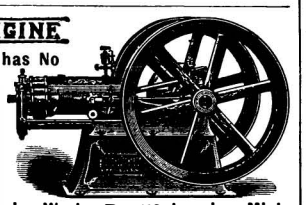

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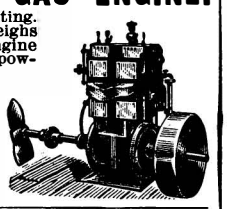

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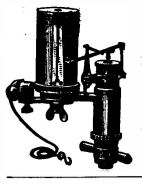

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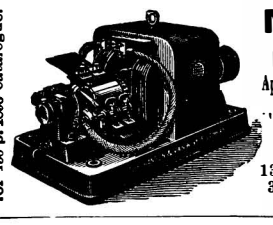

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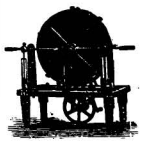

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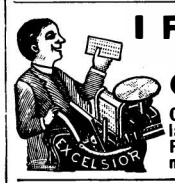

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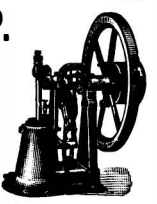

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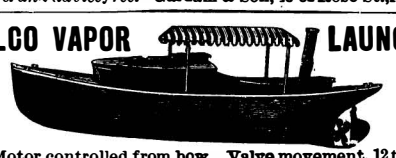

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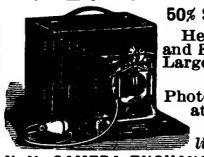

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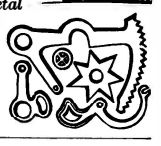

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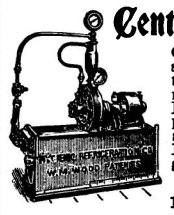

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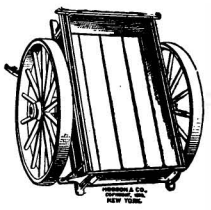

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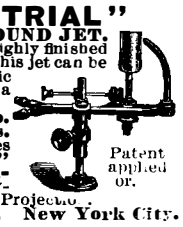

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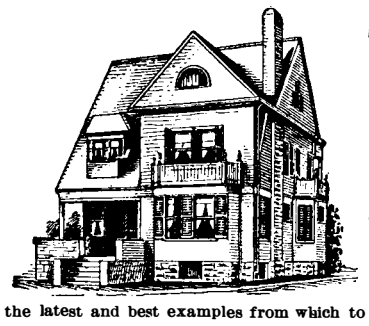

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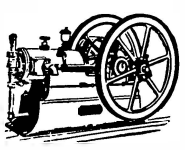

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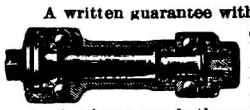

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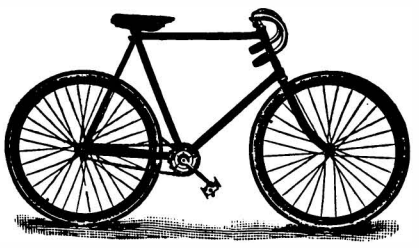

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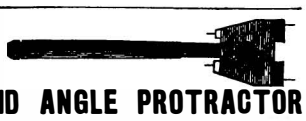

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